ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVI. No. 2. CHICAGO, SATURDAY, JANUARY 8, 1910. ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SEAVER.

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
Publisher's Announcement 65
A Word to Central-Station Managers 65
Some Problems of the Electric Vehicle Solicitor 66
A Dubious Revenue Scheme 66
Income from Street Lighting 67
Telephone Merger Agreement Filed 68
Annual Meeting of the Electrical Trades Society of New York 68
Dr. Edward Goodrich Acheson 69
Manhattan Bridge Opened 69
Annual Report of the Chicago Electrical Department 70
Joint Meeting of American Institute of Electrical Engineers and Western Society of Engineers 71
Copper Production in 1909 72
Electrical Exports for November 72
Foreign Commerce of the United States 73
New Method of Telecontrol 74
Urania-Zurich Electrically Controlled Equatorial Telescope 76
The Incandescent Light and the Arc Light in Medicine 78
Newly Elected Associates American Institute of Electrical Engineers 80
CENTRAL STATION PRACTICE:
Power House Economies in Baltimore 81
Central Stations for Town of 1,000 or 1,200 Inhabitants 83
Performance of a Producer Gas Generator Set 86
Comparison of Central Heating Plant Systems 86
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Tungsten Lamps for Residence Illumination 87
Transformers and Automatic Interrupters for Metallic-Filament Lamps 88
The Latest Methods of Manufacturing Metallic Lamp Filaments—II 89
INDUSTRIAL POWER:
Electrically Driven Pumps—I 92
Power from Windmills 94
Marine Propulsion by Electric Motors 95
An Electric-Motor Attachment for Organ Blowing 96
ELECTRICAL ADVERTISING AND SELLING:
Increasing Current Consumption without Increasing "Kicks" 97
A New House Organ 100
American Production of Tungsten in 1909 100
New York Electrical Society 100
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 101
INDUSTRIAL SECTION:
Power from Exhaust Steam 102
Continued Demand for Steam Engines 102
A Westinghouse Review of 1909 103
Curing Meat by Electricity 104
Weatherproof High-Tension Pothead 105
Graphic Meter in Substation Rendered Possible Reduction in Generating Equipment 106
Allis-Chalmers Company's Review of the Electrical Business in 1909 107
Minneapolis Steel and Machinery Conference 107
New Benjamin Tungsten Fixture 107
Lighting of the Chicago Stock Show 108
The Latest Type of de Forest Radio Telephone 108
CURRENT ELECTRICAL NEWS 109
RECORD OF ELECTRICAL PATENTS 119

Copyright, 1910, by Electrical Review Publishing Company.

PUBLISHER'S ANNOUNCEMENT.

Probably in no field of publishing is the greatest possible refinement of mechanical skill and selection of good material more appreciated than in that occupied by the American technical press. Good printing and well-chosen paper stock are the accepted complements of careful editing and excellence of technical contributions. We are gratified at the hearty expressions of commendation received with respect to the splendid dress of our New Year's Number, last week. This improved appearance has been accomplished through the inauguration of better printing facilities, a new design of the heading, a very choice enamled stock for the cover, and a redress of the advertising and reading pages, printed upon a heavier and better quality of white paper. For these expressions of appreciation and for good wishes for the future received we extend our thanks.

A WORD TO CENTRAL-STATION MANAGERS.

The attention of central-station men throughout the country is especially directed to the policy of the Industrial Power section of this publication, from which much valuable information may be gleaned from time to time showing how to increase the day load, and hence the load factor, overall efficiency, and net returns of electric-generating stations.

In this present issue there appears the first of a series of articles on "Electrically Driven Pumps," the object of which is to indicate the value of electric pumping service from various points of view and which will show the great variety of pumping installations to which electric drive is particularly applicable.

With regard to this phase of electric service it is desired to point out the great advantage of co-operation with the manufacturers, who are always willing and even anxious to draw on their experience in this kind of work with a view to assisting prospective customers in putting in the proper kind of installations.

In later issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN there will appear a co-ordinated series of independent articles on the application of electric drive in shops and factories. By taking notice of what has been and is being done in this kind of work, central-station men will get a line on what sort of business to go after, and the results that may be expected therefrom. In this also, the manufacturers can help to a considerable extent.

SOME PROBLEMS OF THE ELECTRIC-VEHICLE SOLICITOR.

In facing the conservatism of the modern horse-hauled vehicle owner the advocate of the electric truck confronts a difficult problem. The electric vehicle is surely making headway in central-station territory where the attractiveness of a battery-charging load during off-peak hours is appreciated; but there is clearly room for a more rapid development along this line, when the possibilities of the field are once realized. In some parts of the country the solicitor is obliged to overcome the determined opposition of those whose experiments with the early electric vehicles were of an unhappy order. It takes a long time to overcome the prejudices of those who found the early vehicles costly to operate, inflexible in control, comparatively unreliable in continuity of service and short-lived as to battery equipment. In other localities the horse has held the field so long that mere custom makes it difficult to displace him, and there is need of really scientific work on the part of the solicitor before conditions can be changed.

The attitude of the purchaser is the main problem to solve in the introduction of the electric vehicle. The chief obstacle to the introduction of the power truck is not one of guarantees, not one of manufacturing facilities, nor one of commercial records attained elsewhere. It is the plain conservativism of the horse owner, and the line of attack upon this individual's status-quo is the only avenue by which the central-station industry and the manufacturers of equipment can reach the goal of profitable loads, extended sales and economical installations. Ten years of successful and profitable operation is the record of the power truck in several of our larger cities. That both gasoline and electric automobiles of the pleasure type are economic necessities is forcibly attested by the millions of dollars expended weekly in the wages of men employed in this enormous industry. It is time that a similar development went into effect in connection with the power truck.

The electric truck is a machine capable of doing more than three times the work per day that can be handled by horses under favorable conditions. It is more reliable, advertises its owner as up-to-date, and frequently shows a return of from thirty to fifty per cent on the investment. The unsuccessful attempts with the early trucks were partly due to working the machines as experiments; to working them far beyond their capacity; and to inadequate supervision. The modern truck made by a reliable house is also greatly superior in point of design to the older equipment; longer radius of operation and decreased repair bills are insured by the improvement in batteries, motors, driving gear and control, which are today common knowledge among electric-vehicle experts. The day of experiment has passed away among the well-known manufacturers and vehicle engineers.

Investigation shows that power vehicles earn dividends and insure economy of operation, and the wise solicitor, realizing that the change from horse to motor service is no mere demonstration, but involves new methods and ideas, treats this re-organization in an engineering way, based on actual service and the proper selection as well as application of motor trucks. The first step is the study of present service and costs, future service, and the real, though sometimes hardly appreciated, actual requirements of the business. This necessitates careful tabulation of all team trips, with checks of such figures against what the electric truck can do; with re-arrangement of the service, not along the lines of the horse-drawn wagons, but as limited by the actual demands of the customer and his shipments. The next step is the selection of the capacity and number of vehicles for each separate class of service. Both gasoline and electric machines have their representative fields, but the electric is the most reliable, the most efficient and the most satisfactory outfit wherever it can properly be used, notably for delivery within a radius of from ten to twenty miles. It is clean, free from dirt and odor, and always presents a thoroughly attractive appearance; and when supplied with an extra battery will usually furnish all the mileage that one driver can handle day in and day out. The inability of the electric vehicle to race is an important point, since this practice has accomplished the ruin of more gasoline trucks than any one misapplication.

The user of the electric truck avoids all the petty annoyances that stall the internal-combustion engine; and the machine is also thoroughly standardized. This means that close estimates can be made as to the operating and maintenance cost of electric commercial vehicles. With the majority of gasoline machines it is a question whether they can as yet be standardized. This need not debar the consumer of transportation from installing delivery trucks of the gasoline type where the conditions show a definite economy over horse-drawn trucks; but the central-station man ought to take advantage of the possibilities of the electric machine in the way of battery charging, and to advocate its application on the basis of its superior acceleration, as well as ease and simplicity of control.

A DUBIOUS REVENUE SCHEME.

From an English exchange we note that the Smithfield Electric Supply Company, of London, England, has raised its price for electric service from 3.25 pence (6.5 cents) to 4.5 pence (9.0 cents) per kilowatt-hour in cases where metallic-filament lamps are used. It is further stated that the manager of the company estimates that even with the increased rate, the customers using the metal lamps will still make a saving of forty per cent.

If the Smithfield Company desires to limit the use of the metallic-filament lamp with a view to bolster up its revenue it is doomed to disappointment, for no attempt of this kind to prevent the march of human progress has ever been successful for any length of time. Whatever may be the real facts of the case, however, we do not hesitate to condemn most strongly the policy of the new revenue scheme.

INCOME FROM STREET LIGHTING.

Street lighting is the one branch of electrical supply in which the income shows a tendency to become stationary or to decrease. The question is, what are the causes of this tendency and what is the remedy. It will be desirable first to note the facts.

Looking over the past twenty years, it appears that while some electric systems show a continuous increase of the street-lighting income up to the present time, other systems have little more than held their own in this respect during the last decade, and still other systems have sustained a substantial loss of income from street lamps.

From about 1888 to around 1900, the rise of income from street lighting was in most instances rapid and continuous. Since the latter year there has come in some systems a period of nearly stationary income or of decline in street-lighting business. A closer look at the figures appears to show that the income from arc street lighting has usually been the one to suffer reduction, and so the systems that supply only arc lamps on the streets are more apt to show loss of income from this business. Figures from a number of electric systems sustain these general conclusions.

A fairly large city has used arc lamps exclusively for its electric street lighting, and the income to the company operating these lamps rose from $5,362 in 1888 to a maximum of $93,491 in 1902, but has fallen to $74,677 in the present year, or less than it was ten years ago. The same story has to be told of another rather large city that paid $27,314 for arc street lighting in 1888, and a maximum of $83,863, in 1905, but was charged only $74,272 for this service during 1908.

Another small city began with arc street lamps as early as 1888, with a payment of $2,199 during that year, and incandescent street lamps were first installed there in 1890. The largest income from arc street lamps was $5,657 in 1893. For the fiscal year of 1909 the income of the central station in that city was $3,879 from its arc, and $10,692 from its incandescent street lamps, a part of the latter being in adjoining towns. At this date, all of the arc street lamps connected with this station have been discontinued and replaced by incandescents.

Of course there are a good number of companies that show a continuous increase of payments for arc street lighting from its inception to the present time, as does the central station that received $11,668 from this source in 1888, $56,534 in 1900, and $84,371 in 1909. Besides this arc service income, there was $4,972 for incandescent street lighting in 1909, against nothing from this source in 1893.

The fact remains, however, that many electric companies cannot make so prosperous a showing as the last, and for these less prosperous companies there is in nearly every instance a remedy.

While in most cases the numbers of arc street lamps or their equivalent in incandescent lamps have been constantly on the increase, the changes from open to closed arc and then again from the inclosed to the metallic arcs, with resulting economies in operation and reductions in rates, have kept down and often reduced the total street-lighting income.

It is perhaps impossible to reverse the tendency to lower rates in street lighting, and the other means to larger incomes from this source is a much greater amount of this service. Aside from the natural expansion of city territory, the amount of electric street lighting may be increased by displacing gas and oil, and by extending and improving the electric service.

An illustration may be taken from one of the cities referred to where the income from electric arc street lighting reached its maximum at $83,863 in 1905 and was down to $74,272 in 1908. During 1907 this city paid $15,577 for the gas lamps and $31,793 for the gasoline lamps on its streets. For the all-night-and-every-night gas and gasoline lamps the yearly rate was close to $29 each, and for gasoline lamps on a moonlight schedule more than $22 each. Besides this lighting in the city, five towns that bound its sides spend several thousand dollars yearly for oil street lamps.

In one of the great cities of the United States, during a recent year, there were 12,147 gas and gasoline street lamps in use and the payments for the service of these lamps amounted to $371,470. A single state contains one city with more than 10,000, two others with more than 1,000 each, and seven others with more than 300 each of gas lamps, besides thousands of gasoline mantle lamps on the streets.

Tungsten lamps bring this street lighting with small units within easy reach of the central station, and hundreds of thousands of dollars may be added to incomes by displacing gas and gasoline in this service.

Strange as it may appear, with all the increase of the numbers of electric street lamps, what may be termed the density of street lighting has remained about the same in a great number of cities. In other words, the distance from lamp to lamp, and the number of lamps and of kilowatts per mile of lighted streets have remained about the same for more than twenty years, in many instances. Here is another great opportunity to increase the income from electric street lighting, by giving more and better service, for the density of street lighting that could be sold a score of years ago was frequently very inadequate.

One example is typical of many installations. In a municipality of between ten and twenty thousand people, plans were recently made to displace 6.6-ampere inclosed alternating arc with tungsten incandescent lamps on the streets. About four miles, or to be exact, 21,000 feet, of the best lighted streets were measured and the lamps counted, and it was found that thirty-seven of the arcs located on this length of streets averaged 568 feet apart.

Midway between these lamps the illumination was a trifling matter, but even with the three kilowatts here expended per mile of streets much better results would be given by tungsten lamps or metallic arcs, and the improved service would bring more money.

Telephone Merger Agreement Filed.

The agreement completing the merging of the New York and New Jersey Telephone Company into the New York Telephone Company has been filed in the office of the New Jersey secretary of state. The stockholders of the absorbed company receive $142 a share for their stock, to be surrendered on or before December 31. Another provision is that in case not all the stock is surrendered by then, the New York company may pay the money for it to a New York trust company to be designated by its board of directors and thereby be relieved from interest payments on this stock, the trust company to pay when the stock is surrendered.

The agreement expressly provides for a complete merger, the new company to be known as the New York Telephone Company. The directors of the New York company in office before the consolidation are to remain and retain their powers. The consolidation papers are signed by W. D. Sargent, vice-president, and W. Hoppins, secretary, of the New York and New Jersey company, and by U. N. Bethell, vice-president, and John H. Cahill, secretary of the New York company.

The New York and New Jersey company was capitalized at $50,000,000 with $30,021,700 paid in, and this capital will remain. The largest stockholders in the New Jersey and New York company were the American Telephone and Telegraph Company, with 170,314 shares, and the Diamond State company, with 111,886 shares.

Detroit-Chicago-Traction Line.

According to recent newspaper reports, Benjamin S. Hanchett, manager of the Grand Rapids City Railway Company, has announced the formation of a merger of traction, power and gas interests in Michigan. The merger is being brought about by the Hodenpyl-Walbridge interests of New York and E. W. Clark of Philadelphia.

Properties in Grand Rapids, Saginaw, Bay City, Flint, Kalamazoo, Jackson, Cadillac, and Pontiac are affected, the Grand Rapids City Railway Company and the Grand Rapids-Muskegon Power Company being the principal properties involved. It is said that the deal implies comprehensive development of Michigan water power and the completion of a traction line between Detroit and Chicago via Jackson and Ionia, Mich.

Annual Meeting of the Electrical Trades Society of New York.

The fourteenth annual meeting of the Electrical Trades Society of New York city was held at the Railroad Club in the Hudson Terminal Building at 1:30 p. m. on December 14. About forty members were represented at this meeting. There were also present Howard Marshall, president of the New York Credit Men's Association, who gave a brisk talk on the advantages of co-operation as illustrated by the work accomplished in the fourteen years' existence of this association; C. M. Wilkins, the Philadelphia representative of the national board of managers of the National Electrical Trades Association, who spoke in his usual pleasant manner; and John Dale, who made an inspiring impromptu speech full of suggestions. A committee was chosen to arrange for a dinner to be held in New York city during January.

At the election of officers W. C. Hall and B. H. Ellis were elected to the board of directors for three years and A. L. Miller was elected to serve as representative on the national board of managers for the ensuing year.

At the meeting of the board of directors, directly following the annual meeting, P. M. Haight, of the Sprague Electric Company, was elected president of the society for the year 1910; W. B. Wallace, of the Western Electric Company, vice-president; W. H. Roberts, of W. R. Ostrander & Company, treasurer, and Franz Neilson, secretary and counsel. During the past year seventeen new members were elected. The society alone handled upwards of 4,000 claims aggregating more than $250,000, of which seventy-eight per cent was collected through the society's efforts. As compared with the preceding year, there was an increase of thirty per cent of the number of accounts handled. Some of the members collected upwards of $10,000 through the aid of the society.

Navy Wireless Plans.

A sweeping plan for extension of wireless telegraphic service for the navy has been submitted to Congress by Rear Admiral Fowles, Chief of the Bureau of Equipment.

"Wireless apparatus of the latest type," he says, "is to be supplied to all the new vessels of the navy, including destroyers and all auxiliaries, as this latter class of vessel has proved very valuable in establishing wireless chains across long stretches of ocean without the necessity of disrupting the fighting fleet. Until it may become possible to intrust all coast-wise service to the commercial companies, the bureau is obliged to keep the coast chain of stations in the most efficient condition possible, not only for military service, but to warn mariners."

Another shore station is contemplated at Dutch Harbor, Alaska, to carry wireless to Bering Sea, connecting with the Cape Nome station, permitting vessels from Nome to Lower California to keep in touch with the world. After the contemplated high-powered station in Washington has been completed, it is believed similar stations will be found necessary on the west coast of the United States, in the Panama Canal Zone, in Hawaii and in the Philippines. With stations of such power at these places vessels will be within call while going to or from or while in practically all waters where naval operations of interest to the United States might be expected. Each station will cost in the neighborhood of $100,000.

New Steel Works for Chicago.

It is reported that the United States Steel Corporation and its subsidiary companies will make further extensions in the great steel plants between South Chicago, Ill., and Gary, Ind., at a cost of about $100,000,000. New plants will be built during the year, and old plants will be considerably enlarged. President F. J. Buffington, of the Illinois Steel Company, stated a few days ago that details of the work to be undertaken will be officially announced in due time from the main offices of the United States Steel Company.

The extensions mean the employment of possibly 5,000 more men. It is believed that the Illinois Steel Company will erect eight new blast furnaces at South Chicago, and the Iroquois Steel Company at least one new blast furnace; and that this means that South Chicago will keep pace with Gary in the development of the steel industry at the foot of Lake Michigan.

As the recent policy of steelmaking practice, as at Gary, Ind., involves the considerable use of electricity, it is to be expected that further developments in this direction will probably result from the contemplated changes.

Dr. Edward Goodrich Acheson.

Dr. Edward Goodrich Acheson, inventor and manufacturer, was born at Washington, Pa., March 19, 1856. He received his early education at Bellefonte Academy. In 1872 he sought employment in his father's blast-furnace plant, and then took up work as a chainman in a surveying party in Pennsylvania. Much of his spare time and spare money were spent in experimentation and study along electrical and chemical lines.

When he was seventeen years old he invented a drilling machine to be used in coal mining, and later on designed a dynamo which subsequently proved to be identical with the Siemens apparatus. He was with Edison at Menlo Park in 1880, and was assistant engineer of the Edison enterprises in Europe from 1881 to 1883. In 1884 he was superintendent of the Consolidated Lamp Company, of Brooklyn, and electrician of the Standard Underground Cable Company, of Pittsburg, from 1886 to 1889.

During the last twenty years Doctor Acheson has been a pre-eminent figure in the electrochemical world. In 1891 he discovered the chemical compound carborundum, the process being patented in 1893. This compound, which is made from a mixture of coke, sand and salt, fused in an electric furnace, established an entirely new place for itself, and its like has not yet been discovered.

On July 23, 1895, he obtained a patent for producing graphite from amorphous carbon in the electric furnace. At first he devoted himself to the manufacture of graphite electrodes for use in electrolytes where amorphous carbon would be rapidly disintegrated. Later on he worked out a method for using anthracite, which has proved to be the best carbonaceous material for this purpose.

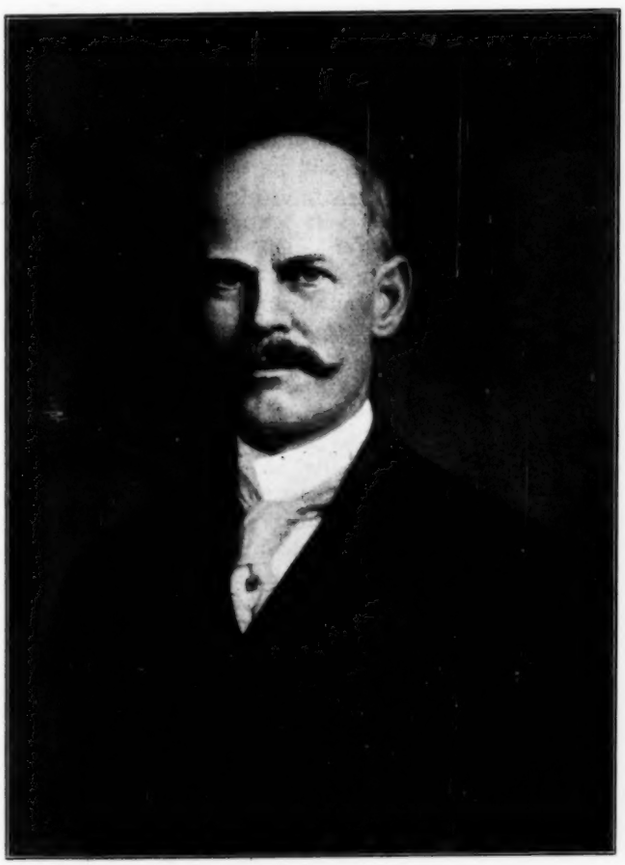
In January, 1889, the Acheson Graphite Company was organized, and the following year was merged with the International Acheson Graphite Company, capitalized at $3,000,000, and of which Doctor Acheson is president. The company's works are located at Niagara Falls, N. Y., and in 1906 over 5,000,000 pounds of electrochemical products were produced.

The scientific world had hardly settled itself again when in the summer of 1906 he discovered a method of producing a soft, unctuous graphite of a purity of over ninety-nine per cent, obtaining his first United States patent for the process on November 20, 1906.

Other inventions of Doctor Acheson are an anti-induction telephone wire, a process for making rubber synthetically, a method for the reduction of the element silicon from sand, and a process for the manufacture of a compound, consisting of carbon, silicon and oxygen, which is now known as "siloxicon," and used as a refractory body.

He has obtained nearly fifty patents in the United States, and many in Europe upon his various inventions. In recognition of his valuable contributions to science, the American Academy of Arts and Sciences in 1907 awarded him the Rumford medal for his applications of heat in the electric furnace for industrial methods. He was twice awarded the John Scott medal by the Franklin Institute of Philadelphia, and he received grand prizes at the Paris Exposition of 1900, and the Louisiana Purchase Exposition in 1904. On December 13, 1909, the Perkin medal was awarded to him.

Doctor Acheson is a fellow of the American Association for the Advancement of Science, a member of the American Institute of Electrical Engineers, the American Chemical Society, the American Electrochemical Society, the Franklin Institute, and of the Society of Arts, of London, England.



DR. EDWARD GOODRICH ACHESON.
Inventor and Manufacturer of Electrochemical Products.

Manhattan Bridge Opened.

Another period in the solution of the New York traffic problem was marked by the opening of the Manhattan Bridge; the fourth great bridge to span the East River and connect Brooklyn to Manhattan.

First to cross this new bridge, on January 1, was Mayor McClellan at the head of a little procession of automobiles, and shortly afterwards the bridge was being used by thousands. After the official openers had passed over the bridge they assembled at the Brooklyn Club and speeches were made by William Berri, former president of the Brooklyn Bridge; James W. Stevenson, the retiring commissioner of bridges; Bird S. Coler, retiring borough president, and others. The men who have had to do with the building of this bridge were highly commended in the speeches made.

The entire cost of this bridge was $20,000,000 and it has been in the course of construction since 1896, contracts having been let as early as 1891. A fact that makes it rather notable is that it will probably be the last bridge to be built over East River. At present the lower cost of construction of subways under the river is much in favor.

It is said that considerably over 1,000 exhibitors have engaged space for the forthcoming Anglo-Japanese exposition in London.

Annual Report of the Chicago Electrical Department.

A preliminary annual report for the year 1909 of the Department of Electricity, City of Chicago, has been prepared by City Electrician Wm. Carroll. From this report the following has been abstracted:

Approximately 2,800 arc lamps have been added to the 9,500 operated in connection with the municipal electric lighting system at the beginning of the year, making a total of 12,300 now in service. Two new substations have been placed in service, one at 1844 South Wood Street and one at 4762 Wentworth Avenue. These stations are of brick, steel and concrete, absolutely fireproof and have a total capacity of 1,350 lights each. During the year the entire system has been operated by current from the Sanitary District of Chicago.

The average cash cost per lamp per year has been a trifle over $42.00, as against $45.86 in 1908 when the changes were being made in the old plants from steam power, and $52.93 in 1907 when steam power was used exclusively. Owing to the increased number of lamps in service during 1910, it is estimated that the average cash cost per lamp will be about $40 per year.

Owing to the installation of arc lamps during the year and the latter part of 1908, 4,455 gas lamps have been discontinued. This, together with economical management, has reduced the cost to the city in this bureau about $52,000 during the year. To this, however, must be added the amount of expense for carrying out the provisions of an ordinance relating to the quality of gas and providing for pressure regulation, passed February 13, 1909.

About $4,000 has been expended during the year in equipping a gas-testing laboratory at 76 Fifth Avenue, in charge of an expert gas tester and his assistant. Provisions are being made for the equipment of three similar laboratories in different sections of the city, at an approximate cost of $6,000.

The number of gasoline lamps has remained about the same, those taken out of service on account of the extension of the electric lights having been replaced in outlying districts of the city.

The work performed in the fire alarm and police telegraph system, has shown a high standard of efficiency, considering the fact that the temporary quarters now used for the fire alarm office down town are not what could be called safe for a system of such importance. There were some severe storms affecting the lines but no interference of a serious nature. During the year this office has received and transmitted to the fire department approximately 10,000 alarms of fire. There have been added ninteeen new fire alarm boxes, making a total 1,915, and eleven police boxes, making a total of 1,200, now in service. Contract has been made for 800 cast-iron police box cases to take the place of that number of old wooden sentry boxes, the expense of which is to be paid jointly by the departments of police and electricity. The sentry boxes are now taken care of by the Police Department. After the installation of the iron boxes they will be cared for by the regular repair force of the Department of Electricity at a saving of about $10,000 a year to the city. During the coming year it is expected to have a fire alarm office and equipment in the new City Hall as perfect as any in existence.

The bureau of electrical inspection has made approximately 66,000 inspections of electrical work and apparatus installed in the city and will show a profit of several thousand dollars over 1908. The rules of this department have now been made a part of the Code by ordinance of date February 1, 1909, which makes it possible to enforce legally the provisions thereof. The bureau has investigated, as in previous years, all fires which occurred in the city. Owing to the close inspection, the low fire loss from electrical causes, noted of late years, has been maintained, thus indicating the value of the inspections in reducing the fire loss. An entirely new system for keeping the records of the office has been introduced, which both simplifies and facilitates the work.

Several new ordinances have been passed recently which will affect the work of the Department of Electricity in the future. Among those is the one regulating the generation, compression, storage, transportation, sale and use of acetylene gas, in which it is made the duty of the city electrician to enforce its provisions; one in which it shall be the duty of the city electrician, or his duly authorized representative, to examine and test any meters used by any person, firm or corporation engaged in the business of supplying electricity to any consumer; and one providing for the creation of a board of public motor vehicle registry who shall examine and license public automobile drivers, and designating the city electrician as the chairman of the board, the commissioner of health and city engineer as other members.

An ordinance is now pending, having been recommended by the corporation counsel and reported favorably from the committee on judiciary, establishing a bureau in the Department of Electricity to be known as the board of examiners of moving-picture operators, consisting of two members, of whom the city electrician shall be chairman. The duty of enforcing the regulations in reference to these machines, monthly inspections of which are now being made, will devolve entirely upon the Department of Electricity, which can then use every means possible to safeguard the public.

Calcium-Carbide Trust in Europe.

Consul-General Henry Bordewich, of Christiania, reports that the manufacturers of calcium carbide of Sweden, Norway, Germany, and England have, since December, 1908, carried on negotiations, endeavoring to come to some agreement relating to the future output and prices to be charged for their products, with the following outcome:

A number of well-attended meetings have been held in different cities, the last in October, 1909, at Paris, France. Here the representatives from the different concerns came to a final agreement, and a trust was subsequently formed. The Norwegian manufacturers are well satisfied, as the industry has given poor returns of late years, owing to low prices. The capacity of the Norwegian plants is about 100,000 tons per annum.

Of European manufacturers, those of France and Italy have not as yet formally joined the trust, but the representatives of the first-mentioned country are said to have bound themselves to avoid all unwise competition. The trust will have two main offices, one at Nuremberg, Germany, for transactions with continental European countries, the other at London, conducting transactions in the British market and with all other countries.

Joint Meeting of American Institute of Electrical Engineers and Western Society of Engineers.

On the evening of December 22 a joint meeting was held of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. The meeting was held in the rooms of the latter society in the Monadnock Block, Chicago. The main feature of the program was the presentation of a paper by Ralph H. Rice, assistant engineer of the division of electrical transmission and distribution of the Board of Supervising Engineers, Chicago Traction, the subject of which was "Low-Tension Feeder Systems for Street Railways."

The meeting was presided over by Prof. P. B. Woodworth. The election of the following officers for the Chicago Section of the American Institute of Electrical Engineers for 1910 was announced: J. G. Wray, chairman; E. N. Lake, secretary; W. B. Jackson and Fay Woodmansee, new members of the managing committee; W. L. Abbott and John D. Nies, re-elected to this committee. It was proposed that the joint meetings of these two sections should be continued during 1910, but that they should be held on the fourth Wednesday instead of the second Friday of each month. The next joint meeting will be held on the evening of January 26, when a paper on "Recent Developments in Automatic Telephony" will be presented by Lee Campbell, of the Automatic Electric Company, Chicago.

At the beginning of Mr. Rice's paper, he referred to the systems under the supervision of the Board of Supervising Engineers as comprising about 687 miles of single track electric surface lines owned by four companies. Of the large number of power houses that were formerly used to supply this network, there now remain only two steam-driven stations. The bulk of the power is supplied through sub-stations that receive 9,000-volt, twenty-five-cycle current purchased from the central-station company. These substations are connected by tie lines through chosen trunk trolley sections, which are normally fed from two stations but in emergency can be operated from either one alone.

In determining the requirements for the feeder system individual car tests were first made so as to find out the current consumption under various conditions of service. The approximate spacing of the cars estimated for the densest traffic conditions in the immediate future was indicated on a large spot map of each company's system. The best methods of sectionalizing the working conductor were then ascertained and a trolley section map prepared to show the load distribution. A "spider diagram" of each system was drawn to indicate from which station the respective trolley sections are fed.

From these various load distribution maps the best locations for all the substations were determined, taking into consideration available sites and a reasonably economical layout of the feeder system. The exact load requirements were calculated for each feeder and the size and number of feeders computed. The two-hour average maximum load was used in these calculations. A feeder route diagram was then laid out. As most of the feeder lines are required to be placed underground by the city ordinance, the conduit layout was next plotted.

For all underground feeders lead-covered, paper-insulated cables were used except in subways and other places where excessive moisture was liable to be met with. In these places the insulation is of rubber instead of paper. For overhead feeders the cables are weatherproof insulated.

Most cables are either of the 1,000,000 or 500,000 circular mil size. Where the cables come up from the underground system and feed into the working conductor or where they change from underground to overhead feeders, a disconnecting switch is mounted in a box on the pole above the terminal pothead, and the lightning arrester is mounted on the other side of the pole. Mr. Rice gave in considerable detail several methods of calculating the load requirements for the various feeders. The distribution of load on the sections was determined on a basis analogous to the problem of finding moments in mechanics.

In the discussion of the paper D. W. Roper spoke of some tests that had been made by the Commonwealth Edison Company to find out whether the rated carrying capacity of low-tension cables could not be exceeded. It was found that this could be done to considerable extent without appreciable harm to the cable. However, when the cables were loaded to twenty per cent above their rating the paraffine insulation was found to have been displaced and the cables suffered.

E. N. Lake said that the 1,000,000 circular mil cable will carry its rated 800 amperes continuously to a distance of about 6,000 feet without exceeding the fifty-volts maximum average drop prescribed by the board. For this reason the ideal system would be one in which the average length of feeders did not exceed 6,000 feet. The average length of the feeders for the two largest systems in Chicago is 6,700 feet.

H. M. Wheeler, of the Chicago Railways Company, showed and explained a number of graphic methods for determining exact distances between cars for various schedule speeds and headways. He also showed a very simple method of determining in special cases the drop to the center of any section and the manner for finding the drop to a section that is supplied from two stations normally when the drop in the voltage of supply from either station alone is known.

Manhattan Bridge Line.

Assemblyman Warren I. Lee filed with the secretary of state at Albany, New York, a certificate incorporating the Manhattan Bridge Three-Cent Line. This new corporation proposes to ask for a franchise, based upon a three-cent fare, to construct a double or single track street surface railroad to be operated by electricity, gas, engine power or such other motive power which may be permitted to a distance of five miles, starting at the intersection of Flatbush and Fourth avenues, Brooklyn, to cross the new Manhattan bridge and to terminate at West and Desbrosses streets in Manhattan Borough, New York city.

The capital is $50,000 and the principal office of the company is in Brooklyn. The leading spirit in the new corporation is Frederick W. Rowe, and associated with him are Frederick W. Wurster, Frank H. Tyler, Andrew D. Baird, Walter Hammett, Edward T. Horwill, Charles Jerome Edwards, Almet R. Latson, Simon J. Harding, John H. Mowen, William F. Neu, Charles E. Perkins, Thomas P. Peters, Morton B. Smith and John C. Beckenbridge of Brooklyn.

An application for a franchise to operate on the new bridge was sent to the New York City Board of Estimate on December 30.

Copper Production in 1909.

Statistics and estimates received by the United States Geological Survey from all plants known to produce blister copper from domestic ores and from all lake mines indicate that the copper output from mines in the United States in 1909 surpassed all previous records.

The figures, which have been collected by B. S. Butler, of the Survey, represent the actual production of each company for eleven months and include an estimate of its December output. The November figures for a few companies were not available and these companies furnished estimates for the last two months of the year. According to the statistics and estimates received the output of blister and lake copper was 1,117,800,000 pounds, as against 942,570,721 pounds in 1908, an increase of over eighteen per cent. This not only exceeds the increase of any previous year but it is considerably greater than the total yearly increase since 1904.

Mine development has been active in most of the important camps, but especially so in the deposits of disseminated ore in Arizona and Nevada. The mines and the smelters of the country are now in a position to make the output in 1910 larger than that of 1909.

Based on reports from the mines and smelters to the Boston News Bureau, the copper production during the month of November is figured at 115,536,888 pounds, compared with 104,700,000 pounds in November, 1908, making the eleven months' production 1,206,000,000 pounds, compared with 972,918,614 pounds for the eleven months of the 1908 year.

The production of copper in the United States for December can be figured at practically the same rate as for November, with the exception of Montana, whose production should show a decline of about 5,000,000 pounds on account of the switchmen's strike.

Production of copper on the American continent, based upon mine and smelter figures of output for 1909, compared with 1908, is estimated as follows:

	1909	1908
Arizona	335,622,000	262,200,000
Montana	312,000,000	293,800,000
Lake	237,000,000	224,500,000
Utah	117,000,000	87,750,000
California	65,000,000	27,750,000
Nevada	53,700,000	7,500,000
Other states	45,000,000	37,000,000
Mexico - Canada	162,000,000	125,000,000
Total	1,317,322,000	1,065,500,000

Production of copper on the American continent is now at the rate of about 1,400,000,000 pounds per annum.

Even allowing that there will be no restriction in production, even though the big copper merger becomes a fact, it is evident that copper production in 1910 cannot reasonably be expected to show an increase over 1909 of over five per cent. It is reasonable to suppose, however, that in future production will be kept more in line with consumption than in the past.

Use of the Mercury-Vapor Lamp for Sterilizing Liquids.

For some time attempts have been made to employ ultra-violet rays for the sterilization of liquid foods. Experiments made by Miroslaw Kernbaum and reported by him to the French Academy of Science seem to demonstrate that these rays, when they act on a liquid, develop oxygenated water which is the real germicidal agent. In one experiment fifteen cubic centimetres of distilled water were subjected to the action of rays from a quartz mercury-vapor lamp. After ten hours a slight formation of gas was observed, and after two hundred hours there were obtained 260 millimetres of gas which was determined to be hydrogen. The water, on the other hand, presented very distinctly all the analytic qualities of oxygenated water. These results corroborate an observation made in 1908 by H. Thiele, who announced that he had obtained oxygenated water by the action of ultra-violet rays, and also an older observation made by Schoene in 1877, who ascertained the presence of small quantities of oxygenated water in snow and rain and attributed it to the action of ultra-violet rays. In whatever manner the destruction of the microbes may be accomplished, the possibility of sterilizing milk, cider, wine, etc., by means of the mercury-vapor lamp has been clearly proved.—*Translated and abstracted from La Revue Electrique (Paris), November 30.*

Boston Edison Company Wins Suits.

Two decisions against the Boston Elevated Railway Company and in favor of the Edison Electric Illuminating Company have been given in the Superior Court, before Judge DeCourcy. The damages awarded in these cases amounted, together with interest, to $14,599.20 The suits were brought for damages resulting to wharf properties of the plaintiff through the operations of the Elevated road on Atlantic Avenue. The Edison Company sought $100,000 for damages to the Liverpool wharf, and the jury placed the damages at $7,480, the interest from June 16, 1901, when the road began to operate, swelling the sum to $10,920. An award of $2,500.20 was made in the $50,000 suit involving Dolbeare's wharf on which the Edison Company held a lease from June 15, 1896, for ten years, and in this case the interest increased the sum of the award to $3,679.20.

Electrical Exports for November.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of exports and imports of the United States for the month of November, 1909. From the advance sheets of this summary the folowing data on electrical exports are taken. As indicated below the total for last November is somewhat less than that for the preceding month, but much greater than that for the corresponding month of the previous year. The latter month was an unusually poor one, however, probably because of the presidential election.

A good indication of what the total electrical exports for 1909 will prove to have been, as compared with the preceding years, is given by the following totals for the eleven months ending with November in each case: 1907, $16,107,263; 1908, $11,414,555; 1909, $11,884,533.

The comparative monthly data are as follows:

Electrical	Nov. 1909	Nov. 1908	Oct. 1909
Appliances	$ 584,210	$463,588	$ 683,819
Machinery	470,687	295,915	443,388
Total	$1,054,897	$759,503	$1,127,207

The principal countries to which electrical products were shipped from the United States during last November with the values of these exports, are as follows:

Exported to	—Electrical— Appliances.	Machinery.
United Kingdom	$ 51,101	$65,603
Belgium	5,615	.....
France	3,608	10,526
Germany	6,362	1,871
Other European Countries	5,766	30,191
British North America	182,409	60,289
Central American States and British Honduras	19,045	25,457
Mexico	105,527	32,748
Cuba	52,375	3,682
Other West Indies and Bermuda	7,427	2,542
Argentina	8,659	18,064
Brazil	81,262	49,009
Other South American Countries	20,120	1,294
British East Indies	.....	15,382
Japan	4,965	90,624
British Australasia	6,568	18,797
Philippine Islands	12,977	3,905
British Africa	3,997	28,011

Foreign Commerce of the United States in 1909.

The foreign commerce of the United States in the calendar year 1909 will exceed in value that of any earlier year with the single exception of 1907. The imports will be larger than in any previous year, while the exports will fall slightly below those of 1906 and 1907.

The above is an estimate of the year's trade based upon official figures for eleven months, as presented by the Bureau of Statistics of the Department of Commerce and Labor. Assuming that the twelfth month, December, will show figures of imports and exports approximately equal to those of the immediately preceding month, November, the imports will aggregate about 1,475 million dollars and the exports about 1,750 million, of which approximately twenty-five million consists of foreign merchandise exported, and the remainder, 1,725 million, domestic products.

Imports free of duty will be larger than in any earlier year in the history of our commerce and will aggregate approximately 700 million dollars, against a little over 500 million in 1908 and 636 million in 1907, the high record year prior to 1909. Dutiable imports will amount to about 780 million dollars, and will be larger than in any preceding year, except possibly in 1907, when the total was 787 million. This estimated total of 1,475 million of imports in the calendar year exceeds by over fifty million dollars the highest import record of any earlier year, that of 1907.

Of this 1,475 million of imports, about 525 million is raw material for use in manufacturing and 260 million partially manufactured material for further use in manufacturing; making the total value of manufacturers' materials imported nearly 800 million dollars, or more than half the entire imports of the year. As nearly as can now be estimated, the imports of the year, classified according to their prospective uses, will be: Raw materials for use in manufacturing, 525 million dollars; partially manufactured materials for further use in manufacturing, 260 million; foodstuffs in a crude condition, 165 million; foodstuffs partly or wholly manufactured, 175 million; and miscellaneous products, about ten million. In each of these classes, except finished manufactures, the total of the year is larger than that of any earlier year, while in finished manufactures the record falls about forty million below that of 1907, when the total value of finished manufactures imported was 380 million.

The large increase in imports occurs chiefly, as already indicated, in manufacturers' materials. In the ten months for which detailed statistics are now available, chemicals (largely used in manufacturing) increased from fifty-five million dollars in 1908 to seventy million in 1909; copper ore, from five million to seven and one-half million; and copper—pigs, bars and ingots from eighteen million to twenty-three and one-half million.

The trade with the noncontiguous territories of the United States for the year will aggregate about 173 million dollars, of which about seventy-eight million dollars' worth consists of merchandise sent to those territories and about ninety-five million merchandise received therefrom. The trade in both directions shows an increase over that of 1908, and this year's total is greater than in any preceding year. From Alaska the shipments to the United States will aggregate about fifteen million dollars, and the shipments from the United States to Alaska about twenty million. From Hawaii the shipments to the United States will amount to about forty-two million dollars, and the shipments from the United States to Hawaii about twenty million. From Porto Rico the shipments to the United States will be about twenty-seven million dollars, and the shipments from the United States to that island, twenty-four million. From the Philippine Islands the merchandise sent to the United States during the year will aggregate about eleven million dollars, against a little over nine million last year; and the merchandise sent to those islands, nearly fifteen million, against practically ten million in 1908.

The exports will be approximately 1,750 million, unless the December totals should differ materially from those of the immediately preceding month, against 1,753 million in 1908, 1,923 million in 1907, 1,798 million in 1906, and 1,626 million in 1905, having thus been exceeded by the export figures of only three years, 1906, 1907 and 1908.

Over half of the year's exports have undergone a process of manufacture before leaving the country. The estimate for the full year shows 465 million dollars' worth of manufactures ready for consumption, and 245 million dollars' worth of manufactures for further use in manufacturing.

All the grand divisions and practically all of the important countries shared in the increased imports. From Europe the imports in the ten months for which detailed statistics are now available show an increase from 436 million dollars in 1908 to 616 million in 1909; from North America, an increase from 194 million to 241 million; South America, from 101 million to 143 million; Asia, from 137 million to 157 million; Oceania, from twenty-one million to twenty-five million; and those from Africa, an increase from thirteen million to fourteen million, comparisons in each case being for the ten months ending with October. On the other side of the account, exports to Europe during the ten months for which detailed figures are at hand show a falling off of sixty-four million dollars when compared with those of last year; North America, an increase of seventeen million; South America, an increase of four million; Asia, a fall of seventeen million; Oceania, a decline of about a half million; and Africa, a decline of about one million dollars; exports to America as a whole thus showing an increase, and those to Europe, Asia, Oceania, and Africa, a decrease.

Aurora Borealis Caused by Neon.

In a statement made before the Division of Physical and Inorganic Chemists of the American Association for the Advancement of Science, at Boston, Dr. L. W. Dudley declared that neon was the direct cause of the aurora borealis. Dr Dudley has what he asserts to be the only sample of uncombined neon in this country and states that the friction of this gas against mercury will produce a yellow light, and that a glow is caused when the gas is acted upon by Hertzian waves. The small quantities of neon in our atmosphere are sufficient to produce the boreal glow.

Radium Found in Missouri.

Samples of pitchblende found near Joplin, Mo., have been analyzed by the Colorado School of Mines and found to be of an excellent grade. The Vinton Walsh research is being used to investigate this discovery further. A fund is available at the school for the extension of radiology in the United States.

NEW METHOD OF TELECONTROL.

BY C. L. DURAND.

A new method of electric wave control or, as it has come to be called, telecontrol, for motor boats, torpedoes and similar craft has been brought out in Germany, and it has already met with considerable success in a number of practical trials which were made of it not long since. The present system was devised by one of the well-known electrical construction firms of Nuremberg, the Wirth, Beck and Knauss firm, and what was desired in the present case was to have a telecontrol mechanism which should possess a simple and at the same time efficient character, avoiding the complications which would be likely to put the apparatus out of order. In some of the recent

VIEW OF SHORE POST FOR TELECONTROL.

tests the apparatus was installed on an electric motor boat of considerable size and was coupled to the steering mechanism in such way that the boat could be steered either to the right or left by the electric waves which were sent out from the station located on shore. The trial took place on the body of water near Nuremberg known as the Dutzendteiche, and the shore post was located in a lighthouse, using an antenna which will be noticed extending down from the upper part of the structure on the right hand side of the accompanying illustration.

The diagram which is here presented will show the essential parts of the telecontrol system. The coherer 38, of the usual metal-plunge type, is connected in the circuit of the battery 37 and a sensitive relay 39. The armature of this relay, 36, serves to close a second circuit including the battery 13, by which the electromagnet 14 is operated. By means of the latter, there is operated the lever 8 which serves to rotate a ratchet wheel 7 by means of a pawl in the usual way each time an impulse is given. At 40 is a tapper for the coherer. Fresh impulses cause

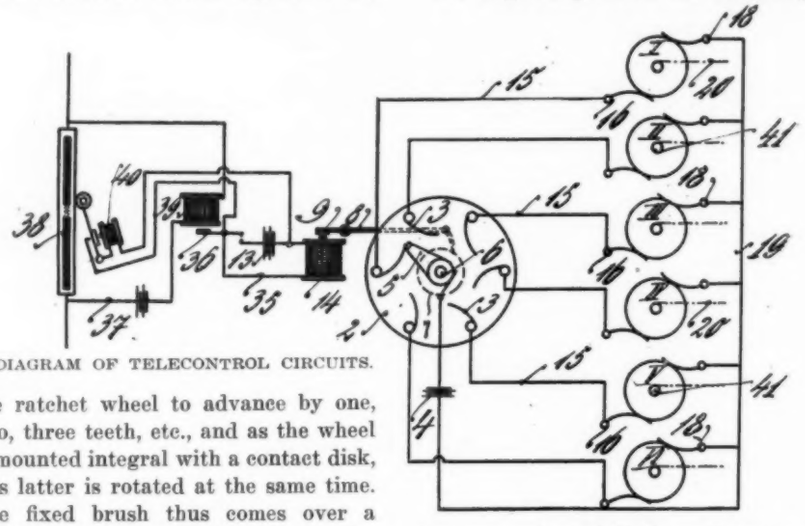
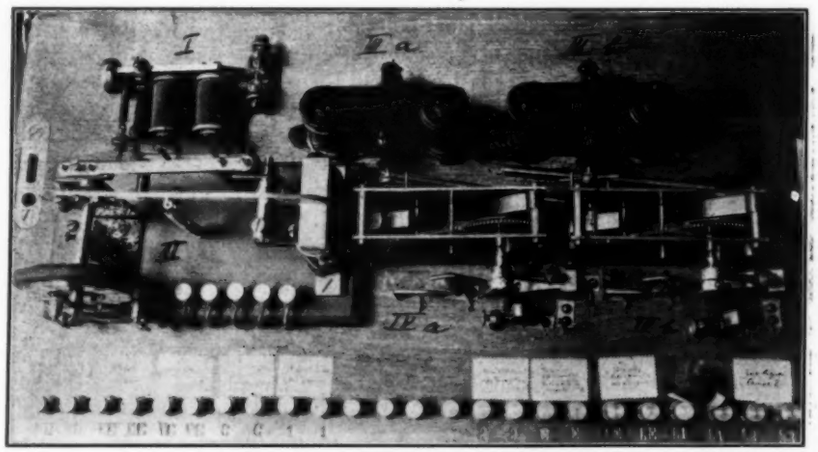


DIAGRAM OF TELECONTROL CIRCUITS.

the ratchet wheel to advance by one, two, three teeth, etc., and as the wheel is mounted integral with a contact disk, this latter is rotated at the same time. The fixed brush thus comes over a metal contact or otherwise over the insulated part between the contacts, according to the position of the ratchet wheel. Should there be a contact piece under the brush, the circuit of the battery 4 is closed, and one of the six electric motors I-VI is set in movement. By the rotation of the motor



TELECONTROL APPARATUS MOUNTED ON TABLE.

there is set working a spring contact device which will be further mentioned and such contact acts to close the circuit of the apparatus which is to be finally worked, such as the movement of the rudder of the boat, etc. A second motor of the series serves to work another apparatus, and there is used one motor of small size for each operation to be carried out. There is an advantage gained in the use of electric motors to make the contacts, owing to the fact that they can be operated by a long contact but not by a short one, and this is one of the advantages of the method.

The engraving shows the mounting of an apparatus which is used for two distinct movements, namely for steering to right or left for motor boats or torpedoes. At I is a relay which is worked by the coherer and at II the contact disk before mentioned. At IIIa and IIIb are two small electric motors for making the contacts, this latter being carried out by the spring contact devices IVa and IVb, one for each motor. The coherer action sends current impulses either direct or by means of the relay I into the electromagnet of the contact disk. According to the number of impulses which are sent, we have the brush placed upon a metal contact or in the insulated in-

terval. When the brush is on one of the uneven numbered contacts, the motor IIIa is set working, and it acts on the spring contact device IVa so as to operate the small contact switch noticed in the front. Such contact thus gives current for operating the movement of the rudder to the left, by a suitable electromagnetic device. When the brush is upon one of the even numbered contacts, the motor IIIb is set running and it works the corresponding spring switch IVb so as to give current for a second magnetic device for bringing the rudder to the right-hand side. The mechanism of the spring contact device is arranged on the retarding plan, so that it first sends out a wave signal which is received at the sending station. Two seconds later, it closes the switch.

Should the brush remain but for a short time upon one of the contacts, this will give no effect, as the motor takes a certain time to start up, and thus the use of the motor gives a method of working by means of long contacts but not by short ones. Such methods are sometimes much more complicated in many of the revolving disk contact devices which are familiar, but here it is carried out in an easy manner and the apparatus is not likely to get out of order. When the brush is upon an insulated part of the disk, the device is inactive and the rudder comes automatically to the zero or central position. The signal which is sent back to the shore post is seen on the paper strip of the receiver, and the operator thus has a check on the working of the apparatus and can correct any wrong working by subsequent signals. The inventors have also devised a method for securing protection against outside disturbances. They propose to use their apparatus for steering torpedoes, and claim that this can be done for five or six miles without any trouble, reaching the enemy's ship and then firing the torpedo. It can also be used for steering airships and like operations.

Railroad Employees Must Buy Stock.

One of the interurban roads operating in the state of Indiana has recently adopted a rule making the taking of stock in the company a condition precedent to procuring employment as conductors and motormen. The plan is said to work well and makes the trainmen careful and courteous. S.

London Underground Railway Plans.

The secretary of the Underground Electric Railways Company, of London, has given out the details regarding the plan to amalgamate the three tube companies, the Great Northern, Piccadilly and Brompton, Charing Cross, Euston and Hampstead, and the Baker Street and Waterloo, for which authority will be asked of Parliament at the ensuing session.

It is pointed out that the amalgamation will do away with the separate boards of directors and separate officials and will facilitate the general traffic arrangements.

Total outstanding capital of the three companies at the present time is $79,700,000, consisting of debentures, preference stock and ordinary shares. The capital of the amalgamated company, to be known as the London Electric Railways Company, will be $84,000,000. Sir George S. Gibb, the present chairman of the three companies, will be chairman of the new and Albert H. Stanley, formerly general manager of the Public Service Corporation of New Jersey, will be general manager.

Holders of the new company's stock will have the advantage of a line on the three roads, instead of, as at present, on only one concern. The new company will control over twenty-two miles of double-tunnel electric railway. Out of the new capital, $2,000,000 debenture stock is to be issued for new work and for general purposes. Through the construction of a new loop it is anticipated that a large increase in through traffic will be gained.

Of the remaining new capital, which will be issued in ordinary shares, $2,000,000 will be paid to the Underground company in respect of the existing indebtedness of the Hampstead Company for extra works carried out by the former, and not included in the original construction accounts, and the balance will be available for general purposes.

The effect of the new financial proposal is shown in the following tabulation:

	Present Company's.	New Scheme.
Debentures	$19,000,000	$21,000,000
Preferred	5,100,000	15,750,000
Ordinary	55,500,000	47,250,000

It is intended to exchange the debenture stock of the present companies for the debenture stock of the new company at par, and to exchange the four per cent preference shares of the Piccadilly company and the Baker Street company for four per cent preference stock of the amalgamated company at par.

According to carefully compiled estimates for the year 1911, the first complete year after amalgamation, the surplus revenues of the new company, after the payment of interest on $21,000,000 debenture stock and four per cent on $15,750,000 new preference stock, will be about $450,000, which will be available for reserves and ordinary dividends. Approximately $55,000,000 of ordinary shares is held by the Underground company and has been deposited as security with the trustees under the deed securing that company's prior lien bonds, 4½ per cent bonds of 1933 and six per cent income bonds.

Chicago Electric Club.

An interesting and instructive address was delivered at the Chicago Electric Club on Wednesday, December 29, following the regular midday luncheon, by Robert N. Holt, assistant corporation counsel of the city of Chicago. "The City Law Department" was chosen as the subject of his address and many of Mr. Holt's listeners were enlightened as to the conditions existing in this department concerning which they hitherto had undoubtedly known very little.

The speaker explained the different sub-departments into which this one department is divided and outlined the class of work coming directly under each department. He compared the law department of the city with a business corporation showing the similarity in the class of work performed, and added that in addition the legal department of this city was also important in all government matters.

Mr. Holt cited interesting cases which come before the various law departments to illustrate points brought out in his address. In conclusion he emphasized the importance of jury service, and stated that this service was one of the greatest duties of the citizen.

President Frederick P. Vose indorsed the points brought out by Mr. Holt, and also cited cases illustrating the importance of obtaining men of reasonable intelligence for jury service.

Announcements were made concerning the third annual smoker and vaudeville entertainment to be held Friday evening, January 7, and indications point to a record-breaking attendance.

THE URANIA-ZURICH, ELECTRICALLY CONTROLLED EQUATORIAL TELESCOPE.

AN UP-TO-DATE INSTALLATION.

At the Urania-Zurich observatory in Switzerland there is an equatorial telescope which is of interest because of its electrical control. This telescope, which was designed and constructed at Jena, Germany, is shown in Fig. 1 mounted for tests on a brick foundation, the overhead traveling crane used in installing the instrument being seen in the background. Fig. 2 shows this instrument as installed within the astronomical observatory tower seen in Fig. 3.

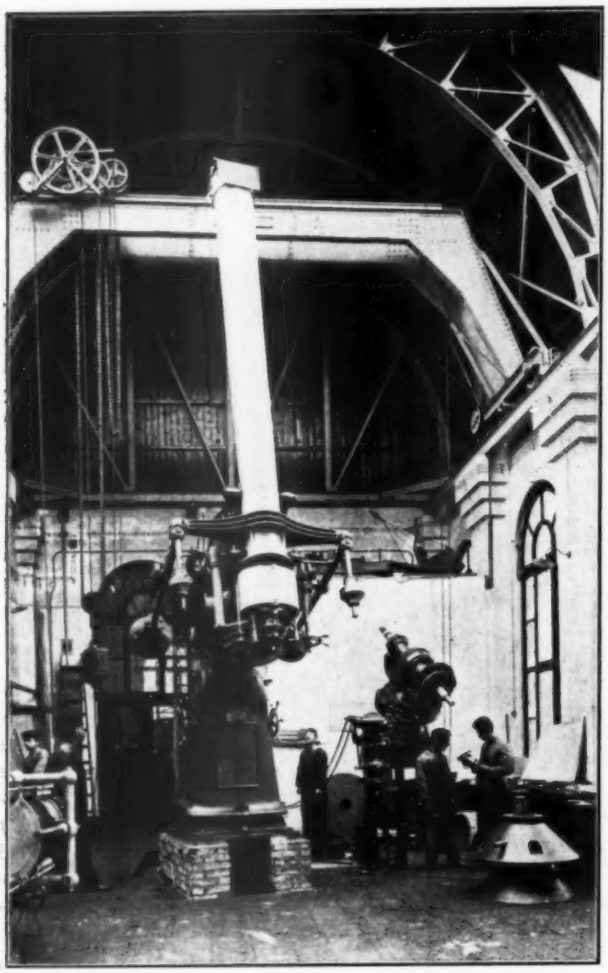


FIG. 1.—URANIA-ZURICH TELESCOPE MOUNTED FOR TEST IN THE JENA LABORATORIES.

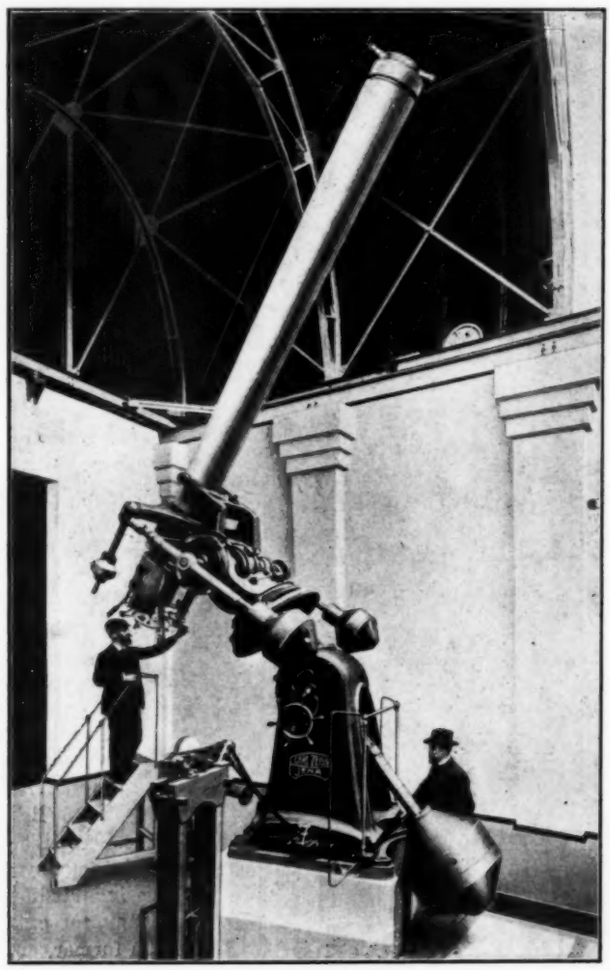


FIG. 2.—INTERIOR VIEW IN THE URANIA-ZURICH OBSERVATORY.

The eyepiece and controlling wheels of the telescope are shown in Fig. 4, while Figs. 5 and 6 show the construction of the electric automatic weight elevator and the astatic friction spring governor with the electric second control used on the instrument. This equipment is not only provided with electrically operated equatorial release system for the hour, but also for declination.

It may be stated that the introduction of photography as an auxiliary to the refractor, and for visual observations of different kinds, as well as for differential measurements and spectroscopic observations, makes it necessary to construct instruments with still greater light-gathering power than heretofore, and as a consequence larger dimensions are necessary, imposing special conditions on the construction of the telescope mountings.

The movable parts of the telescope mounting must be divided into two equatorial systems for holding the instrument on the object observed. There must be complete avoidance of all flexion of the hour and declination axis, with ease of movability about the latter, entirely relieving it from strain, by means of a special supporting system. Moreover the telescope must be so mounted that relative changes of place of the ocular end of the instrument are a minimum, and the mounted auxiliary apparatus (such as astrophotographic cameras) must be within easy reach of the observer at the ocular end.

This Urania-Zurich instrument has a free opening of 300 millimetres, and a focal length of five metres. It has a uniform clockwork for the motion which needs no supervision during observation, with as nearly a perfect construction of the driving power, the governor and the apparatus, as is possible to construct, in order accurately to transmit the motive power to the hour wheel and slow motions.

Figure 5 shows the equipment for automatically winding up of the weight driving the motion by electric power, and Fig. 6 shows the friction spring

governor and electric second control for regulating the driving of the motion. The electric automatic weight elevator is of unique and interesting construction. The weight is suspended by a Galle endless chain and is continuously wound up by the electromotor. A resistance regulates the irregularities in the speed of the motor and the vertical displacement due to them. When these displacements attain a certain position the automatic commutator sets the electromotor in action or cuts it out. When observations are about to be made, the motor is placed in circuit by means of a switch and the winding mechanism is connected with the governor by means of the transmitting shaft.

FIG. 3.—THE URANIA-ZURICH OBSERVATORY.

The friction spring governor is astatic, that is to say, once the velocity of revolution is adjusted, it remains constant by the amplitude of the balls, the centrifugal force being proportional to the distance of the balls from the axis of rotation. This force is always balanced by the tension of a spiral spring suitably connected with the governor arms and by modifying this tension the angular velocity can be regulated between certain limits. It is held that the astaticism of the governor is independent of friction.

In addition to the governor there is provided the electric second control, consisting of a friction coupling and an electromagnetic circuit breaker, and it is brought into action (by a pendulum beating the seconds) by means of a conducting wire noted in Fig. 6. In case an ordinary electric light current is used from a central station, it is necessary to insert a resistance such as

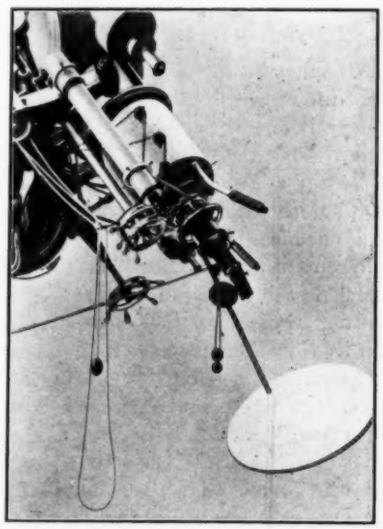


FIG. 4.—EYEPIECE AND CONTROLLING WHEELS OF THE TELESCOPE.

an incandescent lamp into the circuit.

The connecting rod transmits the governor motion to the driving of the hour wheel. There are two driving

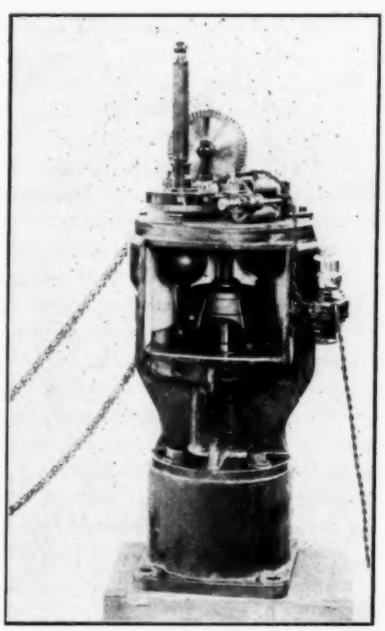


FIG. 6.—ASTATIC FRICTION SPRING GOVERNOR.

periods, worm wheels engaging the hour wheel at two diametrically opposite points. These are coupled together by a shaft so that each worm wheel transmits equal force to the hour wheel. In consequence the hour axis is not loaded by the turning forces, and any possible errors of driving in the hour wheel do not affect the hour motion of the instrument by more than a fraction of their value.

The slow motion of the telescope is operated in two directions at right angles by means of rods from the ocular end. These rods are provided with suitable gearing to permit the speed of the two motions to be rapidly changed from the ocular end.

The Urania-Zurich electrically con-

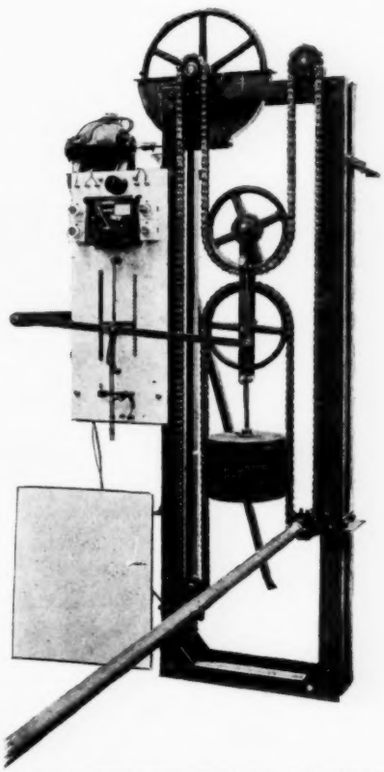


FIG. 5.—AUTOMATIC WEIGHT ELEVATOR.

trolled refractor is said to be one of the finest and most thoroughly up-to-date telescopes in any observatory in the world.

Franchises to Cross Queensboro Bridge, New York City.

The New York city Board of Estimate has passed a resolution granting a franchise to the South Shore Traction Company to cross the Queensboro bridge to the Manhattan terminus, and in Queens continuing by various streets to Jamaica, Long Island. The board also approved the granting of a franchise to the Third Avenue Bridge Company to build a surface railway from Third avenue along East Fifty-ninth street and over Queensboro bridge.

THE INCANDESCENT AND THE ARC LIGHT IN MEDICINE.[1]

BY DR. A. D. ROCKWELL.[2]

There is no more important and efficient method in its relation to therapeutics than the application of light, and although much has been written about it, and much use has been made of it, yet, from the standpoint of those who from personal experience fully appreciate its value, it seems surprising that there is not a more universal recognition of its varied therapeutic properties.

In the few remarks that follow on light therapy it is not my thought to include the whole of phototherapy. I do not propose to discuss the Finsen light which is a very important part of phototherapy, but for the information of those who have a confused idea of what constitutes the Finsen light, and imagine that it is a very simple and easy thing to get, a word may fitly be said. The Finsen light, whether derived from sunlight or the electric arc light, exerts only actinic or chemical effects. In Finsen's original installation, an arc light of 20,000 candlepower was used, and the intense heat thus developed had to be absorbed by an elaborate cooling process, before the ultraviolet rays were available for practical and efficient use. The orginal Finsen lamp required eighty amperes of current and sixty minutes of exposure, but with simplified apparatus good work can be done with five amperes and less exposure. Strictly speaking, the essence of the Finsen light is not light at all, for the ultraviolet rays, having frequencies of almost infinite rapidity, are no more visible than the still higher frequencies of the X-ray, or the far lower frequencies that we appreciate as sound or heat. The effect of the so-called Finsen light then is local and superficial, of remarkable value in the treatment of skin affections, but of little worth in deep-seated morbid conditions.

The ultraviolet ray has no power of penetration. It is immediately absorbed by the blood, and even when the parts are rendered anæmic by pressure or by adrenalin and cataphoric action, its penetration is still comparatively superficial. Used alone and uncombined, it exerts no general constitutional effect, and acts only on the periphery, but, as Finsen demonstrated, is invaluable in dermatological cases and especially in the treatment of lupus.

It cannot be too often repeated that the difference in forms of physical energy is one of degree rather than of kind. The three things that go to make up a complete light treatment, or phototherapy, are the heat, light, and chemical rays which are simply different rates of vibration. Sound, which is a lower rate of vibration, we do not regard of therapeutic value, but as vibrations increase in frequency and decrease in length we get the heat rays, then light (the visible spectrum) until finally we enter the region of the invisible (the ultraviolet), and beyond this the X-ray. Light, heat, and chemical energy constitute the trinity of phototherapy. These combined effects are undoubtedly represented best by the rays of the sun—which when concentrated act more powerfully than those from any artificial source, but for obvious reasons their general and successful utilization is impracticable.

The two available artificial sources of this method of treatment are the incandescent lamp and the arc light, either of which are superior both in physiological and therapeutic effect to the ordinary hot air bath, for the reason that the later is more depressing and far less penetrating than radiant heat, and is without chemical activity. In the administration of light energy, a principle as striking on its moral and intellectual side as on its physical. Electricity, for example, is of value therapeutically only as it meets with resistance, and in the same way, light cures disease, only as it meets the resistance of the human body, and is transformed into radiant energy. The rays from a powerful incandescent or arc lamp readily penetrate the skin, but in overcoming the deeper and denser structures are converted into heat. Heat, therefore, is one of the principal therapeutic factors in the use of the electric light.

It may be observed further, that radiated heat, as developed by the incandescent, and especially by the arc light, results in a more rapid and powerful dilation of the superficial vessels than the action of simple hot air, and this relaxation of vessels, because of no appreciable heating of the surrounding air, can be continued indefinitely. These light rays exert a remarkable stimulating effect upon the peripheral nerve endings, and may be utilized to excite perspiration more quickly than any other method. The superior efficiency of this form of radiant energy in increasing oxidation and tissue changes is evidenced in the elimination of carbon dioxide. As indicated by this elimination, oxidation goes on far more rapidly under the influence of radiant light than of simple hot air. Another well recognized and important factor in the light treatment, more especially with the arc light, is its action on the blood. The hemoglobin carrying power of the red corpuscles is demonstrably increased, and through the influence of its invisible rays upon micro-organisms we get pronounced bactericidal effects.

My first experiences along this line were with the incandescent lamp, not the ordinary incandescent light bath, made up of many small electric bulbs enclosing the body of the patient, but of a single lamp of 500 candlepower.

Placed within a cylindrical metal hood and suspended by a convenient mechanism, the light can be easily applied to any and all parts of the body. For the relief of pain and especially in the treatment of neuritis it is invaluable. I even have gone so far as to say that in the relief of local painful conditions and in its general constitutional influence it was superior to the arc light. In this I believe I was mistaken. After a more extended experience in its use I do not hesitate to assert, that while the arc is quite as valuable as the incandescent light for the relief of pain, its influence upon defective blood and skin conditions is far superior. From what has already been said as to the composition of these two manifestations of light, it is not difficult to understand why this may be so. Both are forms of radiant energy, but in the incandescent or leucodescent lamp, the glass globe effectually intercepts the chemical rays, while the arc light with no intercepting barrier gives the full value of the concentrated solar ray. While, therefore, theoretically it is no difficult matter to decide upon the relative value of these two forms of light and to rule as to some

1 Abstract from the *Medical Record* of December 18, 1909.

2 Neurologist and electrotherapeutist to the Flushing Hospital, New York city.

differential indications for their use, practically it has not been quite so easy. Many cases had to be treated, some by one method, some by the other, with results on the whole seeming to indicate the greater efficiency of the arc light, but it was not until the two methods were successively used in the treatment of the same patients that the superiority of the one method to the other beame strikingly manifest.

Of several cases thus alternately treated, the one here given may be regarded, it seems to me, as especially suggestive and conclusive, and is the basis and inspiration of what precedes:

Miss H., aged sixteen years, I first saw November 13, 1908. Her general appearance was one of extreme inanition and profound anemia. The whole course of the spine was extremely tender to the touch, and she suffered from such severe and constant pain in the region of the ciliospinal center, and down the right arm, and in a lesser degree in the left, that hypodermics of morphine had been a necessity for the preceding two months. Other symptoms there were of occasional hysterical attacks, associated with vertigo and double vision, but for our purpose those given are sufficient. It may be said that among various remedies, iron had been freely taken, but with little if any result. Under the light treatment from the incandescent lamp the patient began to improve. It was applied to the neck, body and arms, the seances being gradually increased from ten minutes to half an hour. Twenty applications were administered at intervals of a day, and for three weeks the improvement was progressive. She was able to dispense with the morphine and the pain in a great measure subsided. During the following three weeks, however, she did not improve further in any marked or satisfactory degree, and for the time being discontinued treatment, yet feeling that much had been accomplished. Some two months subsequently she came again with somewhat increased pain in neck and arms, but not sufficiently severe to compel a resort to morphine. In other respects she was about the same as when last seen—very weak and anemic. The arc light was now used instead of the incandescent, and with results that were soon manifest. The pain very quickly disappeared, more quickly, without doubt, because of the results obtained with the former treatment, but the point of special interest was the ready response in a constitutional way to the newly instituted treatment. The appetite and digestion both improved markedly; there was increase of weight and strength; the improvement in the hemoglobin carrying power of the blood was indicated by a gradual disappearance of her extreme pallor.

Briefly stated, then, the superiority of the arc light to the incandescent in the treatment of certain local surface conditions, and conditions constitutional and general is due to the fact that with light and heat are combined the subtle chemical reactions which are wanting in the other. The arc light represents all the rays of the spectrum as does the sun itself, and practically it is nothing but sunlight. Fortunately, however, for our therapeutic purposes, it is far more controllable than sunlight, and can instantly be made intense or mild, concentrated or diffused, and even the different light rays selected or excluded at will.

National Independent Telephone Association Elects Officers.

At the meeting of the National Independent Telephone Association, which was held in Chicago from December 7 to December 9, the usual policy of electing officers by vote was departed from and a board of directors was chosen. This board has recently announced its choice of officers, which is as follows: Frank H. Woods, of Lincoln, Nebraska, president; E. B. Fisher, Grand Rapids, Mich., vice-president, and J. B. Ware, Chicago, Ill., secretary and treasurer.

The directors adopted resolutions commending the Continental Telephone and Telegraph Company for acting in conjunction with the Independent telephone companies.

Toledo Electrical Show.

Preliminary announcement has already been made in these columns of the determination to hold an electrical show at Toledo, Ohio, in the week of January 31 to February 5. This is to be the first of a series of annual shows under the direction of the Electrical Dealers' Association, of which T. D. Buckwell and I. B. Golden are the managing directors. The show will be held in the Coliseum Building. Arrangements are being completed for a large number of special events in connection with the exhibition. Special days have been set apart for various associations including the American Institute of Electrical Engineers, Ohio Electric Light Association, Michigan Electric Light Association and the Indiana Electric Light Association. An official daily paper will be published containing news pertaining to the show and to live local topics. Demonstrations will be given of various electrical devices, particularly cooking and heating appliances. All the prospects are for a very successful show, as nearly all of the space has already been taken.

Bids for Naval Supplies.

The Bureau of Naval Supplies and Accounts, Washington, D. C., will open bids for naval supplies on the dates given below. Applicants should give schedule number when their bids are sent to the bureau. Copies of the schedules may be obtained from the bureau.

On January 18 bids will be opened for four sets of wireless telegraph apparatus (schedule number 2115) to be delivered at the Brooklyn Navy Yard, and also for 5,000 feet of lead-covered cable (number 2119) to be delivered at the same place. The bureau will also open bids on January 18 for one centrifugal pump (number 2081) for the San Francisco Navy Yard and on February 1 for one twenty-one horsepower engine (number 2114) for Mare Island, Cal.

Third Avenue Plans Opposed.

Notice has been sent to the stockholders of the Third Avenue Railroad Company of New York that the Knickerbocker committee of Third Avenue security holders will oppose the reorganization plan which was proposed by the bondholders' committee, and which is now being looked into by the Public Service Commission.

The notice says that the new scheme is more objectionable than the former plan. Under it stockholders are invited to subscribe $45 a share, and for such subscription they are expected to accept new securities of wholly inadequate and doubtful value. In the event of the plan being rejected by the commission and the shareholders, counsel for the bondholders' committee threaten a foreclosure of the mortgage and a wiping out of the property of the stockholders.

Newly Elected Associates, American Institute of Electrical Engineers.

At the directors' meeting held in New York city on December 16, 1909, seventy-four applicants were elected to membership in the American Institute of Electrical Engineers, as Associates. The list of Associates so elected is as follows:

Alexander, F., 129 Fulton Street; residence, 416 West 122nd Street, New York city.

Anderson, Mark, chief engineer, Kansas City Electric Light Company, 1500 Grand Avenue, Kansas City, Mo.

Bacon, Frederick Thomas Howard, consulting engineer, 30 Church Street; residence, 126 Claremont Avenue, New York city.

Baker, Charles Hinckley, vice-president, American Cyanamid Company, 100 Broadway, New York city.

Baldwin, Robert Lee, supervising electrical engineer, Burns & McDonnell, 823 Scarritt Building, Kansas City, Mo.

Baylie, Walter R., chief draftsman, Helios Manufacturing Company, Bridesburg, Pa.; residence, 3419 Higbee Street, Wissinoming, Philadelphia, Pa.

Bidwell, Morris Chauncey, chief electrician, Universal Motor Company, 1937 Curtis Street, Denver, Colo.

Bowes, William Rauchfuss, Clayton Brothers, 127 Duane Street; residence, 404 West 116th Street, New York city.

Bragstadt, Ole Sivert, Technical University, Trondhjem, Norway.

Camp, Charles Forster, superintendent, M. B. Foster Electric Company, 109 West 26th Street, New York city.

Carey, Albert H., electrician, Black Hills Traction Company, Deadwood, S. D.

Carson J. Philip, Jr., assistant engineer, Electric Construction Company; residence, 2025 Dayton Avenue, St. Paul, Minn.

Clark, James Cameron, instructor in electrical engineering, Case School of Applied Science, Cleveland, Ohio.

Claytor, Charles Hyram, manager, the Tuolumne Transmission Company, and superintendent, Tuolumne Electric Company, Tuolumne, Cal.

Coahran, Jesse Myers, associate professor of electrical engineering, Villanova College, Villanova, Pa.

Colvin, Alla De Witt, assistant in physics and electrical engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

Corrigan, Theodore Elmer, electrician, Standard Consolidated Mining Company, Bodie, Cal.

Cousins, Volney De Los, instructor in telephone engineering, Purdue University; residence, 400 Harvey Avenue, Lafayette, Ind.

Doyle Edgar Dwight, student, University of Illinois, Urbana; residence, 706 South Second Street, Champaign, Ill.

Durand, William Leavenworth, engineer, Bureau of Standards, Washington, D. C.

Ewalt, Greely Roy, foreman of maintenance and cables, Brown Telephone Company, Abilene, Kan.

Fishel, Anthony David, commercial engineer, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Forbrich, Julius J., building superintendent, Y. M. C. A., 502 Fulton Street, Brooklyn, N. Y.

Frost, Alton M., engineer, Moore Electrical Company; residence, Y. M. C. A. Building, Newark, N. J.

Frueauff, Frank W. vice-president and general manager, the Denver Gas and Electric Company, Denver, Colo.

Getz, William Charles, electrical assistant, United States Signal Service, 39 Whitehall Street, New York city.

Glasser, Maurice Mordecai, General Electric Company, Pittsfield, Mass.

Hall, William M., electrical engineer, Porto Rico Power and Light Company; residence, Comerio Falls, Barrio Nuevo, Bayamon, P. R.

Harrison, Noel Faure, electrical engineer, Winnipeg, Man.

Hart, Haynes Lloyd, cadet engineer, Westchester Lighting Company; residence, 15 Adams Street, Mt. Vernon, N. Y.

Hays, James Leslie, electrical machinist and draftsman, electrical engineering department, Baltimore & Ohio Railroad Company, Baltimore, Md.

Henningson, Henning Henry, salesman, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Howe, Albert Mendel, student and laboratory assistant, Rhode Island State College, Kingston, R. I.

Hull, Clarence S., foreman, standardizing laboratory, General Electric Company, Union Trust Building, San Francisco, Cal.

Huntington, Roger Samuel, testing and supervising telephone equipment, New York Telephone Company, 114 West 89th Street, New York city.

Kilner, John Saunders, sales department, Westinghouse Electric and Manufacturing Company; residence, 335 West 78th Street, New York city.

Lewis, Walter W., transformer engineer, General Electric Company; residence, 77 Parker Street, Pittsfield, Mass.

Lister, John George, professor of electrical engineering, British Columbia Electric Railway Company's Technical School, Vancouver, B. C.

Loeb, Albert J., engineering department, Allis-Chalmers Company; residence, 232 Kewannie Street, Milwaukee, Wis.

Lutz, George A., advisory engineer, American Circular Loom Company, Kenilworth, N. J.

MacLeod, Normal MacCallum, telephone engineer, Bell Telephone Company of Pennsylvania, 11th and Filbert Streets, Philadelphia, Pa.

MacNeal, Samuel Robert, vice-president, Bentonville Mining Company, 627 Real Estate Trust Building, Philadelphia, Pa.

Maddox, Wilbur Clinton, Bateman, Garrison, Maddox Company; residence, 615 South Wright Street, Champaign, Ill.

Martin, Freeman Drake, superintendent, the Fort Scott Gas and Electric Company, Fort Scott, Kan.

Moore, Charles Ruby, instructor in electrical engineering, Purdue University, Lafayette, Ind.

Morrison, William Thomas, manager, Bronx district, New York Edison Company, 362 East 149th Street, New York city.

Nicoll, Robert Irwin Davis, engineering assistant, New York Telephone Company, 15 Dey Street, New York city.

Noack, Harry Richard, president, Pierson, Roeding & Company, 407 Monadnock Building, San Francisco, Cal.

Occleston William H., electrical engineer, the Homestake Mining Company, Lead City, S. D.

Orsettich, Robert, electrical engineer, the General Electric Company, Limited, Wilton Works, Birmingham, Eng.

Osborne, Louis J., representative, Fort Wayne Electric Works, 514 Kemper Building, Kansas City, Mo.

Pestel, Arthur, 557 West 124th Street, New York city.

Phair, Harry Gau, electrical assistant, United States Signal Corps, Army Building, New York city.

Porter, Harry Allen, manager, the Robbins & Myers Company, 511 West Jackson Boulevard; residence, 7228 Coles Avenue, Chicago, Ill.

Porter, Leon Walter, president, B. & C. Electrical Construction Company, 40 Charlotte Street, Utica, N. Y.

Putnam, Joseph Franklin, Rockefeller Hall, Ithaca, N. Y.

Reinig, Edward Charles, foreman at generating station, City of Seattle light and power department, North Bend, Wash.

Rhodes, Walter Kremer, professor of electrotechnics, Bucknell University, Lewisburg, Pa.

Rodwell, George Henry, mechanical and electrical engineer, Wayne County Electric Company, Lyons; residence, Clyde, N. Y.

Rose, Fred Wayland, engineer, with Chas. L. Pillsbury; residence, 1973 Carroll Street, St. Paul, Minn.

Rote, John Griffin, treasurer and factory manager, Gillette Safety Razor Company, 41 West First Street, Boston, Mass.

Ryan, Thomas Francis, chief electrical engineer, Guanica Centrale, Ensenada, P. R.

Schulte, Edward Delavan Nelson, associate professor of electrical engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

Seidel, Carlos Maria, Oficios 22, Havana, Cuba.

Sharp, Harry Lyman, meter inspector, Niagara, Lockport and Ontario Power Company, Fidelity Building, Buffalo, N. Y.

Smith, Jay L., electrical engineer, St. Joseph Railway, Light, Heat and Power Company; residence, 1510 Lafayette Street, St. Joseph, Mo.

Stanley, Erwin, commercial engineer, General Electric Company, Pittsfield, Mass.

Sweet, Felix L., superintendent, Texas-Mexican Electric Light and Power Company, Eagle Pass, Tex.

Terrell, Wendell Phillips, professor of mechanics, Prairie View State Normal and Industrial College, Prairie View, Tex.

Turner, Claude Vernon, superintendent, Laurel Creek Electric Company, Lawton, W. Va.

Vogel, Abraham, electrical engineer, Mitchell & Mussigbrod, Warm Springs, Mont.

Whaley, W. Junius, salesman, the Wesco Supply Company; residence, 20 South 20th Street, Birmingham, Ala.

Wiggert, John F., assistant electrician, Homestake Mining Company; residence, 312 Sawyer Street, Lead, S. D.

Williams, Wynant James, instructor in electrical engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

At the same meeting the following former Associates were transferred to the grade of Member:

Beach, Howard L., electrical engineer, Pennsylvania Coal and Coke Company, Cresson, Pa.

Ricker, Charles William, electrical engineer, Cleveland Construction Company and the Warren-Bicknell Company, Cleveland, Ohio.

Wallau, Herman L., electrical engineer, Cleveland Electric Illuminating Company, Cleveland, Ohio.

Census Enumerators Scarce.

Census Director Durand recently stated that there were evidences of a great scarcity of enumerators for the United States census this year, and urged public-spirited and responsible persons to make application for these positions as soon as possible.

About 68,000 enumerators will be required. Each will work in his own locality. Any competent person is entitled to apply for this position.

The enumerators will earn about $60 each. Those in the rural districts must complete their work within thirty days, and those in cities of 5,000 and more population at the preceding census within two weeks, from April 15, 1910.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

POWER HOUSE ECONOMICS IN BALTIMORE.[1]—I.

BY HORATIO A. FOSTER.

During the summer of 1906 the service of the United Railways and Electric Company of Baltimore had become very much troubled by serious though temporary failures of the power supply. The main power station at Pratt Street on the harbor had not been completed and the smaller steam-operated stations scattered throughout the city were only adequate for small amounts of power; the substations fed from the central power station were not, at the time, equipped with sufficient machinery to supply the output called for without much overloading; the cables connecting the central power station with the substations were scarcely heavy enough to carry the rapidly increasing load, moreover the company was continually adding to the service by replacing old and small cars with those of greater carrying capacity, which demanded a much greater amount of power.

The power station at Pratt Street had been most seriously damaged by the great fire of February 19, 1904, so that but three of the old direct-current units were available, and those for a short time only, as the city had decided to take the opportunity to widen Pratt Street, for which purpose it appropriated about sixty feet off the front of the lot upon which this damaged house was situated. The new power house to replace that which was destroyed by fire had been designed within much shorter limits and so laid out as to accommodate three new 5,000-kilowatt reciprocating units, and the three old 1,800-kilowatt units still in operation in a temporary wooden shed on the old site on Pratt Street.

At this time, September 1, 1906, arrangements were made with L. B. Stillwell, of New York, to assume entire charge of the power plants of the company, not only for construction, reconstruction, and all necessary engineering changes, but for reorganization of the operating force and the complete operating of the plants from coal supply to trolley wire. As soon as practical a force was organized under the direction of the writer, and the problem of insuring the supply of power, as far as possible, during hurried additional construction was taken in hand.

The first requirement of the power plant of a street railway system is absolute continuity of operation; the next, that its operating cost shall be as low as compatible with continuity of supply, and last that the cost of construction shall not be excessive.

A study of the distribution system developed the fact that there were many points along the road that were very poorly supplied with current, for in addition to lack of power not enough copper had been installed during the period immediately preceding to keep up with the demand made by the additional and larger cars put into service. In fact, the whole situation was serious and demanded quick and heroic treatment. The late General Hood, then at the head of affairs, and W. K. House, at the time general manager, together with the whole engineering force attacked the problem with vigor and enthusiasm.

The first thing demanded, as the holidays were fast approaching, was an increase of the alternating-generator plant, for a reserve, and an addition to the cables connecting the generating plant with the substations. Arrangements had been made sometime previously for an increase of plant in the one substation which was apparently much overloaded. Fortunately a practically finished turbo-generator of 5,500 kilowatts capacity was found which could be purhased and shipped in sixty days, although through an accident while testing, it was delayed more than a month, and contracts were immediately entered into for a foundation for this machine. New boilers were already under way on an old contract, and a new high-tension cable, contract for which had been let the previous July, was hurried along and installed on Christmas Eve. Happily it was not needed.

With these arrangements completed, more time could be taken to study the general situation, and the layout for future demands as well as the immediate supply was given much consideration.

In the summer of 1906 the equipment of the United Railways Company consisted of nine power stations and five substations, as follows:

	Alternating Current. k.w.	Direct Current. k.w.
Pratt street		5,400
Pratt street	15,000	
Light street		2,000
Carey street		400
Gilmore street		500
Preston street		800
Falls Road		2,250
Back River		424
Bear Creek		675
Owings Mills		1,080
Total capacity	15,000	13,529

The five substations were as follows:

	k.w.
Druid Hill, capacity of rotaries	4,500
Northern or Harford Road	4,000
Eastern Avenue	3,000
Nunnery Lane or Arlington	1,500
Dugan's Wharf, temporary	3,000
Total capacity	16,000

Of the above mentioned stations, those at Bear Creek and Back River were only used in summer or in some emergency where the source of alternating current at Pratt street might be cut off for a time long enough to warrant starting them up. Bear Creek was equipped with Climax boilers and a 375-kilowatt Westinghouse-Kodak machine; a 300-kilowatt dynamo belted to a pair of engines of which the cylinders and frame had been very badly wrecked didn't count. The Back River plant consisted of plain return-tubular boilers,- with old-fashioned Thomson Houston dynamos belted to high-speed engines.

The station at Owings Mills is so far from the city as to put it out of consideration in any central source of supply

[1] Reprinted by permission, from the *Journal* of the Franklin Institute, November, 1909.

of current except it might in time be furnished from the line fom McCall Ferry. It is equipped with return-tubular boilers, one Rice and Sargeant engine, direct-connected to a 330-kilowatt dynamo, and three high-speed engines belted to three 150-kilowatt dynamos. The engines all run condensing.

Of the others, Light Street station is equipped with water-tube boilers, Corliss type of non-condensing engines and 500-kilowatt belted dynamos. If it had been possible to get condensing water for this plant, its economy could have been scarcely excelled, as the engines were of good type and the operating force competent though small.

Carey Street had Climax boilers, and high-speed engines with small belted dynamos.

Preston Street was equipped with water-tube boilers and a good type of compound, non-condensing, moderate-speed engines with belted generators of quite an old type, which could never be made to give voltage exceeding 550.

Gilmore Street was equipped with return-tubular boilers and high-speed engines of the Armington Sims make of quite the oldest type, and belted generators of comparativedy small capacity.

Falls Road station had Corliss type, vertical, and Climax boilers; Corliss type of compound condensing engines belted to comparatively large generators. There were also two Westinghouse Kodaks in an addition at one end of the building. This station was quite well equipped, well located to take its proper load, and being well supplied with condensing water should have been quite efficient. But it was woefully uneconomical in operation, and could never be run at anything like its full capacity owing to the inability of the generators to commutate the current when loaded.

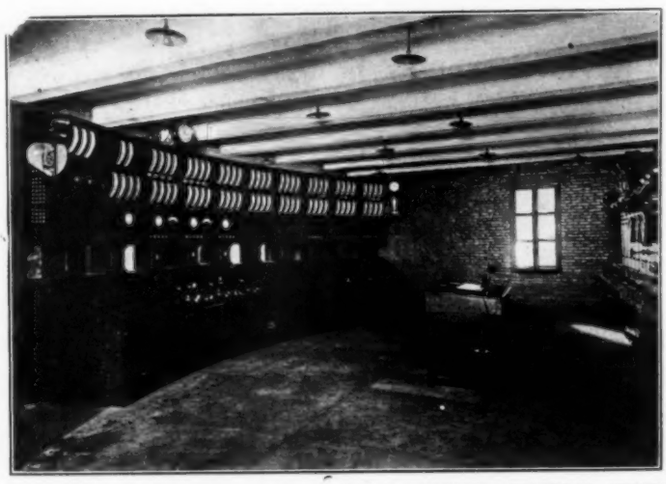
The central power station at Pratt Street is located at the land end of a long pier which extends a long way into the harbor. Water for condensing purposes is taken in on the west side and discharged into the dock on the east side of the pier. Coal is unloaded from barges directly into the storage bins in the top of the boiler house.

This station was equipped with five 2,000-kilowatt, direct-connected generators on vertical compound condensing engines of quite the latest type; one 5,000-kilowatt generator direct-coupled to a double, vertical-horizontal, compound, condensing engine and three 1,800-kilowatt direct-current dynamos direct-connected to vertical compound condensing engines. There were twenty boilers of 480 horsepower each, and more were being added at the time, as steaming capacity was badly lacking.

As to the substations, while the total nominal capacity of 16,000 kilowatts was 1,000 kilowatts more than that of the generating station, there was no reserve at either point, and before additional supply could be installed, the generators of 15,000 kilowatts capacity were often called upon for 18,000 to 20,000 kilowatts, while the Druid Hill and Hartford Road substations were putting out at times very heavy overloads and needed relief as soon as it could be furnished, in fact a 1,500-kilowatt rotary had already been ordered for the Druid Hill substation.

The substation on Dugan's Wharf immediately in the rear of the Pratt street power house, had been put there temporarily, following the fire, and would be dismantled just as soon as other provision could be made to supply its output.

A complete study of the situation developed the fact that with the construction of one new substation located near the center of the city, the increase in the size of the substation at Hartford Road, the readjustment of the copper to meet these changes, and the addition of the conductors necessary for putting the direct-current distribution into proper condition, the temporary substation at Dugan's Wharf could be abandoned, the steam station at Light Street could be shut down, all the smaller steam stations could be put out of service and the whole supply of power would then be developed at a higher efficiency at the central power house at Pratt street.



PRATT STREET POWER STATION. ALTERNATING-CURRENT CONTROL SWITCHBOARD.

PRATT STREET POWER STATION. ALTERNATOR OIL-SWITCH GALLERY.

The supply of power at the Bay Shore resort still remained in question

and the great increase of traffic expected during the following summer called for a supply which should be positive and continuous.

One of the most serious problems was the design and location of a switchboard which would not only take care of the output of the machinery then in use, and that to be immediately added, but would handle the power supply for a long time in the future. Tentative plans were made showing possible additions to the plant that could be located on the remainder of the Pratt Street lot owned by the company, and it was found that an additional capacity of 40,000 kilowatts could be made. The switching gear and structure were, therefore, so designed as to be easily enlarged to care for this increase. During the planning a contract was entered into with the McCall Ferry Power Company for a supply of 10,000 kilowatts of current from that source, and the switchboard had still further to be arranged for the accommodation of this power. As power interchange with the Consolidated Gas, Electric Light, Heat and Power Company must be kept always available, room for this was also made. This required a switchboard which would control current from one station in sight; two out of sight and at some distance; water power thirty-five or forty miles away, and a power house located about two or three miles off.

The switchboard has been designed so that if carried out to its ultimate limit it will be capable of controlling about 120,000 kilowatts.

The duct problem then developed an acute stage, for it was with some difficulty that room could be found on the narrow wharves left on either side of the power house to accommodate all those needed to carry all the cables made necessary by the requirements above mentioned. The situation was much relieved, however, by changing the original plans of placing the three 1,800-kilowatt direct-current units along the north wall of the newly constructed engine room of the Pratt Street power station, and building at this location the switching structure. In addition to this a large vault was constructed in Pratt Street under the sidewalk along the front of the building, into which all cables entering from the ducts on the street are taken for distribution to their proper places. A more detailed description of this structure will be given later.

DIRECT CURRENT SWITCHBOARD.

Means had to be supplied also for handling the direct-current output from the three 1,800-kilowatt dynamos, and again for distributing the current from this source to a large number of outgoing feeders. This was all very satisfactorily accomplished by suspending a light steel structure from the inside of the east wall of the main power house, about twenty feet above the floor, and placing upon it the necessary switch panels and instruments. The cables for both machines and feeders are run up back of this structure through ducts built up against the wall, and held thereto by a light framework of steel and expanded metal, the whole being plastered over to a smooth surface.

(To be continued.)

Foreign Electrical Plant in England.

At the annual dinner of the Institution of Electrical Engineers, held at the Hotel Cecil in London, Eng., on December 8, Dr. Gisbert Kapp, the president, deplored the habit which obtained in England of depreciating the English electrical industry. He pointed out that out of about 1,000,000 kilowatts of electrical apparatus in use in England, only about 80,000 kilowatts were of foreign manufacture. This, he said, did not look like decadence.

Northern States Power Company Formed.

Articles of incorporation have been filed at the Secretary of State's office, Dover, Del., for the Northern States Power Company, of Chicago, with capital of $10,000,000, the objects of which are to furnish gas and electricity for light, heat and power purposes. The incorporators named are E. J. Graf, Mathew A. Morrison, Garrison Growvig and F. W. Stearns, all of Chicago, and Warren W. Aiken, of Wilmington.

Plans for Another Boston Subway.

It has been announced that the construction engineers of the New York, New Haven & Hartford Railroad are working on plans for a tunnel beneath the city of Boston to connect the two terminal stations. It is said that the work at present is preliminary, and that the matter needs the approval of the Legislature.

The plans carry with them a project for the electrification of the suburban system of both the New Haven and the Boston & Maine railroads.

CENTRAL STATIONS FOR TOWNS OF 1,000 OR 1,200 INHABITANTS.[1]—I.

BY CARYL D. HASKINS.[2]

When the electrical industry was comparatively young, the greatest interest was displayed in the establishment of new plants to supply electricity for illuminating purposes, and the activity along these lines was so great at that time that installations were made in almost all communities of sufficient size to warrant the outlay.

Since that time the electrical art has progressed with almost marvelous rapidity, and communities in which plants were established, many of which were at that time comparatively small, have also grown from the rank of towns to that of cities.

The result has been that gigantic installations which have grown up in the last few years have monopolized the greater portion of the talent and the time of those men who have made a specialty of electrical development; and the installation of new plants in comparatively small or medium size communities has not received the attention from the engineering fraternity that it did in the past.

During this period a new generation of towns has grown up, and today there are a vast number of communities in the country which are of sufficient size to support an electric-lighting plant, and which are in a position to demand the best that the world has to offer in the line of artificial illumination.

While it is true that the interest of our greatest electrical men has been diverted from channels of new development to the problems incident to larger installation, the interest through the country at large has been greatly increased. This is evidenced each day by the large number of inquiries which are received, asking for information as to the cost of installations and operations of electrical plants for towns ranging in population upwards from 500 people.

It is the purpose of this article to answer some of these general questions and to provide preliminary facts and figures on the costs of such installations.

Owing to the marked increase in efficiency, sturdiness and simplicity in the design of electrical apparatus, together

1 Reprinted, by permission, in slightly condensed form, from the *General Electric Review*, November, 1909.

2 Manager of the Lighting Department of the General Electric Company, Schenectady, N. Y.

with an even more marked decrease in first cost, towns which ten years ago could not have supported electrical plants, may now advantageously consider installations.

In making an estimate of the costs and apparatus necessary to install an electric power plant in a town of 1,000 people, there are many factors which must be predetermined in order to obtain figures which will exactly apply to any set of local conditions.

The best that can be done in making up a general proposition is to presuppose certain factors, derived from averages in a large number of particular cases. In making such general figures applicable to any one definite locality, the greatest care should be exercised in determining the exact value of these factors under such local conditions.

Probably the two most important items for determination are: (1) The length of service which the plant shall supply; (2) the kind of fuel which will give the cheapest and most satisfactory results. It has, therefore, been thought expedient to make our general figures on plants operating for both power and lighting: that is, twenty-four hours a day; for plants doing a lighting business alone, running from sundown to ing hours of service in the winter, the average operation being about six hours a day, and for each of these plants two types of fuel have been considered, coal and natural gas.

The uses of electricity are increasing so rapidly at the present time that almost every day brings to light some new application, and for this reason every new company should carefully consider the possibilities of service for power purposes; and if this cannot be profitably carried on under the present condition, provision should be made for maintaining a twenty-four-hour service some time in the very near future.

It is perfectly obvious that power business can be taken on at much lower rates than ordinary commercial lighting business, as the hours of service are much longer and the peak load very much less pronounced. Moreover, the same machinery which is used in a strictly lighting plant only six hours a day may be operated twenty-four hours; thus getting four times the amount of work from the same invested capital.

Before proceeding with the detail estimates it might be well to state that the freight item, on account of its large variation, has not been included, and it has also been assumed that water may be obtained without cost. Further, it has been necessary to make arbitrary assumptions, based on average conditions, on the cost of fuel, poles, land, etc. The figures are throughout conservative and in all cases a ten per cent item has been added to cover extras.

Twenty-Four-Hour Plant.—While it is by no means a common condition, there are many towns of 1,000 to 1,200 people, which have industries of sufficient size to support twenty-four-hour service, and if in such a locality a connected load of eighty horsepower can be obtained in motors, it will most certainly pay to install a plant for this service.

In making an estimate the first problem that presents itself is the determination of the capacity of the plant. This is done in the following manner:

The connected lighting load for a plant operating twenty-four hours a day in a town of 1000 or 12000, usually consists of about:

	Horsepower.
1500 sixteen candlepower multiple incandescent lamps = 60 kilowatts	80.5
60 sixty-watt series incandescent lamps = 3.60 kilowatts	4.83
5 arc lamps = 2.5 kilowatts	3.35

In addition to this, we should expect a connected load of not less than eighty horsepower in motors. The day or motor load will slightly overlap the night load; this must therefore be considered in figuring the size of installation.

Fifty per cent of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to daylight, therefore, the total load on the station would not exceed fifty per cent of the connected incandescent load (sixty kilowatts) or thirty kilowatts plus 6.1 kilowatts (8.18 horsepower) the arc load necessary for street lighting, or 36.1 kilowatts (48.4 horsepower) which figures do not include line loss.

A plant of 100 kilowatts (134 horsepower) capacity will be of ample size to furnish this amount of energy, including all loss incident to the transmission, for the peak caused by the overlapping of day and night loads and allows for spare apparatus to cover emergency condition.

The total cost of a building for such an installation, including the foundation and real estate, should not be more than $1,650.

LIST OF APPARATUS IN GENERATING STATION.

Boiler Room.

Two seventy-horsepower return-tube boilers at $725	$1,450.00
Masonry	550.00
Piping, inc. connection to engine	250.00
Foundation for heater and pump	25.00
Haulage	75.00
One steel stack, 100 horsepower	135.00
One feed-water heater, 100 horsepower	150.00
One boiler feed pump, 100 horsepower	110.00
Two injectors, $15 each	30.00
Total	$2,775.00

Engine Room.

Two seventy-five-horsepower, high-speed, simple engines, $1,050 each	$2,100.00
Foundations, each $100	200.00
Installation, each $100	200.00
Two fifty-kilowatt, sixty-seven horsepower generators, $805 each	1,610.00
Two belts, $50 each	100.00
Switchboard	500.00
Two two-and-one-fourth-kilowatt CQ exciters, $150 each	300.00
Two belts, $10 each	20.00
One constant-current transformer	220.00
One two-kilowatt transformer for station lighting	30.00
Installation, wiring, foundation, etc.	220.00
Total	$5,500.00
Franchise and legal expenses	350.00
Building, including real estate	1,650.00
Total cost of station	$10,275.00

These figures are conservative, and it is probable that by careful supervision the cost of the plant could be considerably reduced.

After generating the current at the station, it is necessary to carry it to the consumers. The method of carrying it, or transmission as it is commonly called, depends upon the size of the town. If the station can be located in the most thickly populated portion, that is, at the center of distribution, and if seventy-five per cent of the load is within 1,250 feet of the station, the current may be at low voltage; *i. e.*, 220 volts.

There are many advantages of this system in that it obviates the use of transformers and brings the current through the streets at the same pressure as is used in the houses.

On the other hand, unless the load is distributed as outlined above, the cost of a low-voltage installation is out of all proportion to its advantages, and in this case it is expedient to use a pressure of 2,300 volts, and transformers to reduce the voltage. The problem of distribution is one which must be solved for each individual case, and when making a definite estimate of the cost of a plant, it is recommended that a map of a town be furnished (or if this is not available, a sketch) showing the streets, the probable location of the

power plant, and where the current will be used, and send it to the manufacturers. With this information they will gladly give a recommendation which will exactly meet the requirements.

The cost of a typical distribution using 2,300-volt, three-phase with transformers is:

Ten five-kilowatt (6.7 horsepower), pole, H.B. type, transformers	$500.00
Five two-kilowatt (2.68 horsepower), pole, H.B. type transformers	145.00
Four one-kilowatt (1.34 horsepower), pole, H.B. type transformers	76.00
Nine miles of No. 6 wire, weight 3,600 pounds; poles, inc. cross arms, insulators, pins, etc.; line construction; five arc lamps at $25	1,550.00[1]
Sixty series incandescent lamps at $7	420.00
Ninety recording wattmeters at $12	1,080.00
Total	$ 3,771.00
Total central station cost	10,275.00
Total first cost of entire installation	$14,046.00
Ten per cent for extras	1,417.00
Grand Total	$15,463.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

OPERATING EXPENSES.

Fixed charge, including depreciation, insurance and taxes, ten per cent.	$1,558.80
Engineers' salaries (two men, one at $720, one at $600)	1,320.00
Superintendent's salary	900.00
Coal, 700 tons at $2.75 per ton	1,925.00
Oil, waste, etc	100.00
Incidentals (supplies)	200.00
Office expenses	250.00
Total operating expenses	$6,253.80

INCOME.

Arc lamps, $70 each	$ 350.00
Series incandescent	1,350.00
Power (a conservative estimate)	2,800.00
Commercial lighting	3,450.00
Total	$7,950.00
Total operating expenses	6,253.80
Profits to be divided among stockholders or set aside for sinking fund	$1,696.20

Equals 10.89 per cent on money invested.

When operating twenty-four hours per day at an average load of 14.7 kilowatts (19.7 horsepower) per hour, the output of the plant will be 352 kilowatt-hours (472 horsepower-hours) per day, or a total of 128,500 kilowatt-hours (172,000 horsepower-hours). This figure divided into $6,253, the total operating expenses for the year, shows a cost of approximately 4.85 cents per kilowatt-hour for the power generated.

The revenue from the various classes of service and the proportion of the total kilowatt-hour output represented by each may be enumerated as follows:

Street Lighting (All Night Service).—The load represented by this class of service, including fifteen per cent for loss in transmission is 25,530 kilowatt-hours, or approximately twenty per cent of the total output.

Power.—We have previously assumed a power load 59.6 kilowatts (eighty horsepower). If 700 kilowatt-hours per year equals the consumption per connected horsepower, the total load from this class of service would be 56,000 kilowatt-hours. At five cents per kilowatt-hour this service would yield an income of $2,800. The total load represented plus twenty-five per cent for loss is approximately 70,000 kilowatt-hours, or fifty-five per cent of the total output.

Commercial Lighting Load.—As has been already stated, the total connected commercial lighting load in this plant will be approximately sixty kilowatts. Fifty per cent of this load, or thirty kilowatts, will be the peak load taken by the commercial lighting service at any one time, and seventeen and one-half per cent of this peak load may be considered average load which will be demanded during a period of twelve hours. On this basis we have a consumption of 23,000 kilowatt-hours per year paid for at the rate of fifteen cents per kilowatt-hour.

Assuming that but seventy per cent of the generated power is delivered and paid for, the station output for this class of service will be 33,000 kilowatt-hours per year, which amount allows the large item of 10,000 kilowatt-hours for line, transformer, and meter losses and for bad debts.

GAS ENGINE PLANT.

For localities where natural gas can easily and cheaply be obtained, in which the price of coal is so high that gas presents itself as a more attractive fuel from a financial standpoint, we would recommend an installation using gas engines. The size of the equipment will be estimated in the same manner as it was for the steam plant. The connected load will also be the same.

A plant of 100 kilowatts capacity would be of ample size to furnish this amount of energy.

The total cost of a building, including the foundation and real estate, should not be more than $1,200.

LIST OF APPARATUS IN GENERATING STATION.

Two seventy-five-horsepower gas engines, complete with fifty-kilowatt generators	$8,000.00
Foundations, each $100	400.00
Installation, each $150	300.00
Two three-and-one-fourth-kilowatt CQ exciters, each $150	300.00
Two belts, each $10	20.00
Switchboard	500.00
Constant-current transformer	220.00
One two-kilowatt transformer for station lighting	30.00
Installation, wiring, foundations, etc.	220.00
Total	$9,990.00
Building, including real estate	1,200.00
Line material, same as in steam plant	3,896.00
Legal expense	350.00
Total	$15,436.00
Ten per cent additional	1,543.00
Grand total	$16,979.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

OPERATING EXPENSES.

Fixed charge, including depreciation, insurance, and taxes at ten per cent	$1,697.00
Engineers' salaries (two men, one at $720, one at $600)	1,320.00
Superintendent's salary	900.00
3,599,000 cubic feet of gas at thirty cents per 1,000 cubic foot	1,080.00
Oil, waste, etc	200.00
Incidentals	400.00
Office expenses	250.00
Total operating expenses	$5,847.00

INCOME.

Revenue, same as from steam plant	$7,950.00
Total operating expenses	5,847.00
Profits to be divided among stockholders	$2,103.00

This equals approximately 12.4 per cent on the money invested.

This is based on the assumption that gas is availabzle at thirty cents per thousand cubic feet, and that the fuel consumption will not exceed twenty-eight cubic feet per kilowatt-hour. While this consumption may very probably be materially bettered it is in line with the conservative assumptions made on fuel consumption of steam engines.

(To be continued.)

1 This item varies somewhat widely, depending upon the locality.

The following table is compiled from actual figures submitted by operating companies in the locations indicated:

POLE-LINE COSTS PER MILE FOR 3-PHASE, 2300 OR 6600-VOLT

These figures do not include painting and are exclusive of bookkeeping, overhead charges, and the like.

No.	Item	Omaha	Kansas City	Montana	Minnesota	Texas	Tennessee	Average
50	30-foot poles	$275.00	$287.50	$200.00	$200.00	$171.00	$180.00	$218.90
50	Pole hardware	10.00	7.10	16.00	12.50	8.30	7.40	10.25
50	Cross-arms, 2-pin	17.50	7.25	11.50	15.00	17.00	16.00	14.00
150	Insulators	16.50	6.00	11.20	6.00	6.75	7.00	9.00
	Labor setting	80.00	90.00	200.00	125.00	55.00	100.00	109.00
	Labor stringing wire	25.00	15.00	40.00	50.00	30.00	40.00	35.00
	Incidentals	25.00	41.00	50.00	30.00	10.00	20.00	30.00
	Total	$449.00	$453.85	$528.70	$438.50	$297.05	$370.40	$426.15

Electrification in South Africa.

A scheme is being promulgated for electrifying the railroad between Pretoria and Johannesburg.

PERFORMANCE OF A PRODUCER-GAS GENERATOR SET.

BY R. E. LAMPMAN.[1]

The electric-generating equipment of the Incorporated Town of Hartley, Iowa, consists of an eighty-horsepower Muenzel producer-gas engine, by the Minneapolis Steel and Machinery Company, Minneapolis, Minn., belted to a fifty-kilowatt Westinghouse three-wire direct-current generator. The plant started operating in February, 1909, and has been running under a constantly increasing load, until now, at peak load, the engine is delivering one-half of its rated power at the switchboard.

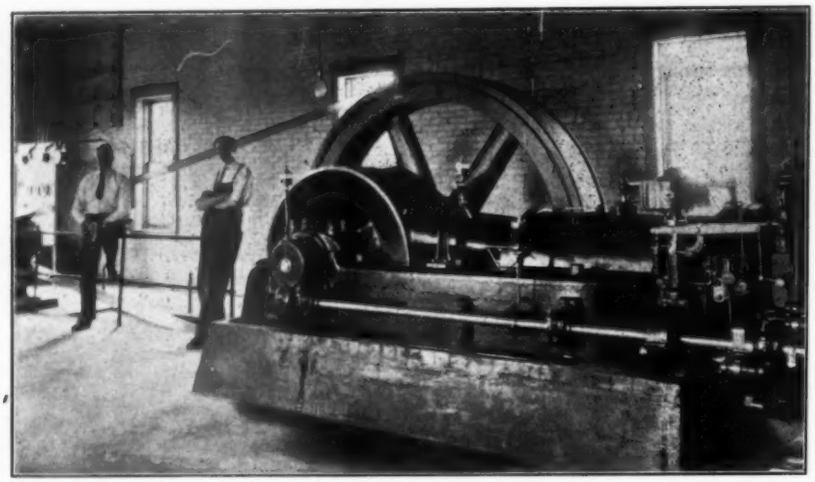
Like all well-designed machinery of its kind, the producer-gas engine will operate most efficiently at or near its rated capacity. From daily reports, made on printed itemized sheets for this purpose, with a constantly increasing kilowatt-hour output from month to month, it was apparent that the coal consumption per kilowatt-hour is considerably greater at light load than at heavier loads.

The writer entered on his present duties on June 1, 1909, so that nearly all the records of the plant date only from that time, as no records, except for a few in May, were kept previously. For the month of October the coal consumption increased slightly on account of the morning runs beginning that month. The plant runs from dark until 12 o'clock midnight, and from 5 a. m. until light. The two daily startings-up of the plant, therefore, may account for this slight increase, owing to the unavoidable losses in blowing up the fires twice a day instead of once as previously.

From the data sheet given herewith,

Month	Coal in pounds	Output, K.W.H.	Pounds of Coal Per K.W.H.	Total cost, in cents, per K.W.H. at switchboard	Cost for Coal per K.W.H.
May	11,100	1,422	7.78	.....	....
June	9,320	1,234	7.63	12.48	2.38
July	7,920	1,257	6.30	11.40	1.98
Aug.	7,400	1,550	4.77	9.40	1.49
Sept.	9,500	2,460	3.90	6.10	1.22
Oct.	13,260	3,315	4.0	4.97	1.25
Nov.	15,370	3,842	4.0	4.40	1.25

which was compiled from the daily reports, it will be noticed that the fuel consumption per kilowatt-hour has decreased as the load has increased, except for the last two months recorded, the increase in these months being due to the morning runs as previously stated. Reducing kilowatt-hours to horsepower-hours and figuring the efficiency of transmission and efficiency of the generator at about one-half capacity, the cost per horsepower-hour is quite low for fuel when it is taken into account that the engine is developing only half power at peak load. If the engine could be operated at near its rated capacity, it would certainly turn out power at an amazingly low cost. For the month of December (up to the time of writing—near the end of the month), the coal consumption works out to 3.9 pounds per kilowatt-hour.



THE PRODUCER-GAS GENERATOR SET AT HARTLEY, IA.

The producer-gas outfit for small plants is, in the writer's opinion, the only thing that will meet operating expenses on light load. A steam plant running on the kind of load that obtained with this plant during the months of June, July and August, would not have paid for much more than the coal consumption, to say nothing of salaries and other incidental expenses.

[1] Superintendent of the municipal water and light department, (Incorporated Town of) Hartley, Iowa.

Comparisons of Central Heating Plant Systems.

Joseph T. Maguire, in an article entitled "Comparison of Forced-Circulation Hot-Water, and Vacuum Steam Central Heating Plants," which appeared in a recent issue of *Engineering News*, says:

"In the great majority of cases, intelligent study will show that the vacuum-steam is some ten per cent cheaper in interior pipes and fittings, and about five per cent cheaper in central-station fittings. In the cost of radiators, future extensions, conduits, there is no great advantage of one system over the other. But in the cost of outside pipe lines there is a saving of some fifty per cent with the hot-water plant, and in operating expenses this system is anywhere from fifteen per cent upward more economical than the vacuum-steam."

Aerial Navigation by Wireless.

A method by which aviators may determine their position by wireless telegraphy has been offered by F. Lux, of Ludwigshafen, Germany. In this system it is proposed to establish a network of wireless stations each of which is to emit automatically a simple identifying signal at definitely recurring time intervals and arranged so that signals from adjacent stations would not occur simultaneously. The receiving station for each aerial craft would weigh approximately three kilogrammes and would cost from about $25 to $37.50, the cost of each land apparatus being about $250. Herr Lux estimates that about ninety stations would suffice for the German Empire, and that the yearly upkeep for these stations would in all probability not exceed $12,500.

Electrical Enterprise in South Africa.

The London *Electrician*, quoting a leading South African paper, states that the municipality of Durban has decided to seek power to borrow the sum of $2,150,000, to be expended on various public works during the next five years, including $500,000 for electric lighting, and $300,000 for electric railways.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

TUNGSTEN LAMPS FOR RESIDENCE ILLUMINATION.

BY CHAS. T. PHILLIPS.

Only a few years ago, in selecting a system of lighting for the average residence, there were only two illuminants from which to select without patronizing the Standard Oil Company. One was gas with the Welsbach mantle or the ordinary lava tip and the other, the carbon filament electric incandescent lamp.

Both of these systems had their disadvantages. To the high maintenance and depreciation of the Welsbach mantle is added the objectionable heat in the summer and the unhealthful condition arising from the use of gas in closed living rooms.

While the carbon incandescent lamps have no effect upon the atmosphere, nor is the small amount of heat given off objectionable, they depreciate rapidly, frequently giving only sixty per cent of their rated candlepower (their rated life being 900 hours). I have made tests on sixteen-candlepower carbon lamps that had been burning 400 hours and they gave only ten candlepower, and others that had been burning 900 hours gave seven candlepower. This deterioration is frequently caused by fluctuations in the voltage, impressing a higher voltage upon the lamps than is intended, and causing a rapid blackening of the bulbs and weakening of the filament.

Although carbon filament incandescent lamps are rated at 900 hours actual life, they frequently burn much longer especially when the voltage is low. In fact I have known these lamps to burn 2,000 hours. These lamps are now generally rated at 500 hours life, the candlepower having depreciated to eighty per cent of their rated candlepower. This is known as their useful life. This change in rating is made so as to compare them with the later type of metallic filament lamps, also to show that it is cheaper to discard the lamps at that stage and to install new ones.

The metallized carbon filament lamp or the tantalum filament lamp will not be considered in this article, although they are a great improvement over the carbon filament lamp.

The tungsten filament lamp operates at 1.25 watts per candle, the highest efficiency of any incandescent lamp on the market. The excellent quality of its light and the remarkably small current consumption have led to its wide adoption for store and street lighting. On account of their fragility, the 110- and 220-volt tungsten lamps are not generally suitable for residence lighting; also for the reason that they are not made in the smaller units, the twenty-five watt (twenty candlepower) being the smallest standard 110-volt lamps now on the market.

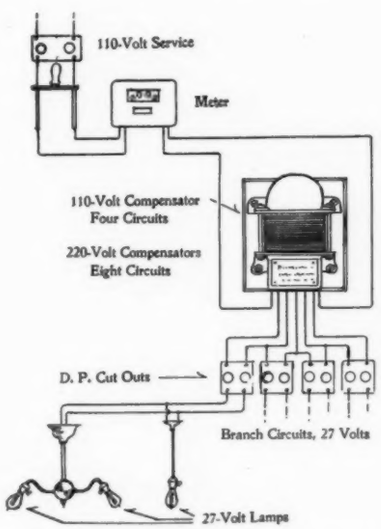


DIAGRAM OF COMPENSATOR SYSTEM.

To fill the requirements of residence lighting, or where an efficient lamp of low candlepower is required, the low-voltage tungsten lamp has been developed. These lamps are rated at twenty-seven volts and made in ten, fifteen, twenty, twenty-five and forty watt sizes, yielding eight, twelve, sixteen, twenty and thirty-two candlepower, respectively. They will stand as rough handling as carbon filament lamps without danger of breaking the filament.

For decorative effects these lamps are made in still smaller sizes, but on account of the voltage being still lower (about ten volts) they would hardly be practical for residence lighting, and are used only where a great number are needed in a small radius, such as for signs, outlining buildings, etc.

The tungsten filament, being a metal, has a positive temperature co-efficient of resistance which makes it less liable to damage from voltage fluctuations and the candlepower and general efficiency remains practically the same throughout its life, which is 800 hours. The fact that the tungsten filament has a positive temperature co-efficient makes the candlepower more constant on voltage variation than the carbon filament, which has a negative temperature co-efficient.

This is shown by the table below giving the candlepower at various voltages of a sixteen candlepower, 110-volt carbon lamp and of a similar tungsten lamp.

Volts	Carbon Lamp C. P.	Tungsten Lamp C. P.
88	4.5	6.9
100	8.5	11.0
105	12.0	13.3
110	16.0	16.0
115	21.0	19.0
120	27.0	22.5

In the low-voltage system of tungsten lighting, where the line voltage is 110 or 220, two or three wire, which is standard for commercial lighting, it is necessary for the current to be alternating, so that it can be reduced to twenty-seven volts by installing a compensator or economy coil in the building.

These coils consume a very small amount of current in their operation and should be installed at the center of distribution. If the circuit is longer than the average, care should be taken to see that the drop will not be excessive, especially if the twenty-five and forty-watt lamps are used.

I have laid out a number of these installations, and have found that the best results are obtained by using ten and fifteen-watt lamps (eight and

twelve candlepower), as the twelve candlepower tungsten lamps compare very favorably with sixteen candlepower carbon lamps, in fact I have substituted the twelve candlepower lamps for the sixteen-candlepower carbon lamps and they certainly appeared to give more light. This may have been on account of the superior quality of the light or the carbon lamps may have been old. I did not make a photometric test on the carbon lamps taken out to see if they were giving their rated candlepower.

In back halls, closets, porches, cellars and other locations it is generally unnecessary to use a sixteen-candlepower lamp. An eight-candlepower or smaller lamp should be used. In the carbon lamps the eight candlepower size consumes thirty watts; four candlepower, twenty watts and the two candlepower, thirteen watts. The old sixteen-candlepower lamp consumes fifty-five watts or 3.5 watts per candle.

The current consumption in the smaller carbon lamps being so much higher per candle, it hardly pays to use them, but in the tungsten lamps, the current consumption is the same per candle in all sizes, that is 1.25 watts per candle.

One drawback in the low-voltage system is that the standard line of electric fans, heating and cooking devices will not operate on the same circuit, as they are generally designed for 110 volts or higher, and even if rebuilt for twenty-seven volts the high amperage is apt to cause an excessive drop on the system, causing the lamps to dim, and if the compensator is not large enough it may be damaged. I did have some cooking apparatus and small fans rewound for twenty-seven volts but the results were not satisfactory. The fans did very well, but the cooking utensils were not practical.

The above conditions only apply for the standard system of wiring. If the building is wired especially for the low voltage the obstacles mentioned could be easily overcome, otherwise it is better to run separate 110-volt circuits for fans and heating devices.

The theoretical saving in current is 64.3 per cent with the low-voltage lamps over the carbon lamps. In actual practice I have found the saving to be from fifty to eighty per cent.

While the first cost of the lamps is much higher than the carbon lamps, the saving in monthly current bills will soon pay the difference, especially if the rate is over four cents per kilowatt-hour. Even with a three-cent rate, it pays to install the low-voltage tungstens. The superior quality of the light would recommend this system regardless of the efficiency.

There are also a number of small plants in country homes using this system, the dynamo generating direct current at twenty-seven volts and being driven by a gas engine or some other prime mover. A storage battery used in conjunction necessitates running the engine only part of the day, the batteries taking care of the load the balance of the time.

The compensators are manufactured

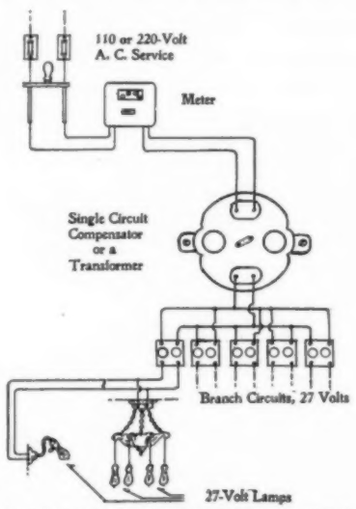


DIAGRAM OF COMPENSATOR OR TRANSFORMER WITH ONLY ONE SECONDARY CIRCUIT.

by most all of the large electrical manufacturing companies and the expense of installing them is nominal.

Transformers and Automatic Interrupters for Metallic-Filament Lamps.

In order to facilitate the use of metallic-filament lamps, the construction of which is still rather delicate for the customary tensions, several firms have begun the manufacture of small transformers for lowering the normal tension in the installation. Although this auxiliary apparatus causes some loss of energy, the metallic-filament lamps are so much more economical than the older ones that a great saving is still effected by their use. In order to prevent the losses which would be occasioned by the necessity of maintaining the transformer constantly in circuit, even when no lamps are used, the idea has recently sprung up of equipping each lamp with a transformer mounted on the ordinary support. Such small transformers have a lower efficiency than a general transformer would have, but they prevent the losses in the conductors already mentioned. Following this idea of combining the transformer with the lamp to its conclusion, there is attained what may be called an induction lamp, in which the filament would be closed on itself within the bulb, have no outside connections, and be supplied with current by induction from a primary winding outside. At the present time transformers are put on the market by various manufacturers for the usual frequencies and for secondary tensions of twenty-five to fifty volts and intensities of five to 100 amperes. A considerable saving may be effected by cutting the primary circuit of the transformer when no lamps are in use. When an auto-transformer is employed this may be done automatically by adding an automatic interrupter. This apparatus consists simply of an oscillating lever, which connects, in one of its positions, the feed-wire to the lamp circuit by means of a self-induction coil, and in the other position establishes a direct-connection.—*Translated and abstracted from L'Electricien (Paris), December* 4.

More Light for the Same Money.

Torquay, England, is one of those towns that has not suffered a decrease in electric-lighting revenue from the introduction of the metallic-filament lamp, as a recent report issued by the electricity department of the town council shows that the decrease in current used by the new lamps has been made up by customers using more light and by new installations made possible.

Fishing by Electricity.

The Indiana fish and game warden, as well as the Indianapolis, Columbus & Southern Traction Company are trying to break up a novel plan of taking fish from White River by electricity. The trolley line skirts the river for some distance between Franklin and Columbus and the miscreants tap the trolley wires and then place the other end of the wire into the water. When the wire and current comes near a school of fish they turn up stunned or dead and are taken out of the water with scoops. The traction company's officials say that these fishermen interfere in no small degree with the operation of cars. S.

THE LATEST METHODS OF MANUFACTURING METALLIC LAMP FILAMENTS[1]—II.

BY B. DUSCHNITZ.

MANUFACTURING FILAMENTS FROM SUBSTANCES FREE OF CARBON BY THE WET PROCESS.

A — *With Colloids* — The colloidal tungstic acid ($H_2W_3O_{10}$), which was first prepared by Graham, when combined with a little water forms a tough, sticky fluid. Johann Lux, of Vienna, employs this as a binding material in the manufacture of tungsten filaments. According to German patent No. 200,938 a plastic mass is prepared from finely powdered tungsten metal and a concentrated solution of colloidal tungstic acid. Filaments pressed from this mass and dried by a moderate heat are said to be capable of being subjected, immediately after drying, to the effect of an electric current in a vacuum or reducing atmosphere, whereby the object of electrolytic dissociation of the tungstic acid and the sintering and welding of the tungsten metal into a cohering body is attained. If the reaction is carried out in an atmosphere of hydrogen, its course is as follows:

$$W + H_2W_3O_{10} + nH = 4W + 10H_2O + nH.$$

This is, the reaction of the powdered tungsten and colloidal tungstic acid with n parts of hydrogen produces a filament consisting of four parts of tungsten and ten parts of hydrogen and water, always provided that the reaction has been entirely completed.

In the preparation of plastic masses from colloids by Kurzel's well-known process it has been observed that the colloidal metals frequently contain considerable quantities (up to twenty per cent) of oxides and hydroxides of the metals employed, in various stages of oxidation. These oxides and hydroxides are said to possess the property of increasing the plasticity and solidity of the colloidal masses before and after drying. In order to obtain or increase this advantage Dr. Hans Kuzel, of Vienna, and the Justus Pintsch Company, of Berlin, add to the colloidal metals oxides or hydroxides of difficultly fusible metals in a colloidal state. If, for instance, five to twenty parts of brown tungsten dioxide are mixed with ninety-five to eighty parts of one of Kuzel's well-known plastic masses, the physical properties of the same are said to remain unchanged, but their cohesion is said to be increased thereby. Plastic masses of identical properties are likewise said to be obtained, if very finely powdered metals or metalloids are added to the colloidal tungsten oxide, say from ninety to eighty parts of powder to ten to twenty parts of the colloidal oxide, and this mass is mixed thoroughly by kneading or otherwise, until it is homogeneous. All these masses become electrically conducting only after heating, and they are said to furnish good filaments after they have been reduced and gradually brought to white heat in an atmosphere of hydrogen.

The method so far followed by Kuzel has been to slowly dry the filaments, which consist of difficultly fusible colloidal metals without any addition of finely powdered elements and to subject them to a high heat, preferably by the passage of an electric current, in order to transform them into the ordinary or crystalline condition. For this purpose they had to be preheated, as in a cold state they are not conducting for currents of 110 to 220 volts. Recently, however, it has been found possible to send a current even through very thin filaments consisting entirely of colloids, and thus to transform them into the crystalline condition without preheating. To do this a tension of 400 to 1,000 volts is necessary. This observation is undoubtedly of great practical importance, as it considerably cheapens the manufacture and does away with special preheating apparatus In carrying out the process there is a danger that with increasing conductivity the filament will burn through, and in order to prevent this, resistances are connected in the circuit, which permit a reduction of the tension in the measure that the conductivity increases, preferably in an automatic manner.

During the process of reduction and sintering hollow spaces and channels are frequently formed in the interior of the filaments, which decrease their life. The phenomenon has been observed not only in filaments prepared from oxides with organic binding substances, but also in those of colloidal materials, and they are of inferior value or unsuitable for use on account of their irregular cross section. Dr. Kuzel assumes that these hollow spaces in colloidal filaments are filled with the gases in which the reduction takes place, and their formation must not be prevented, because the reduction of the interior of the filament would then become impossible and the hollow spaces would come into existence during the use of the lamp and cause its destruction. It is practicable, however, to make provisions that will allow the gases to escape and cause the hollow spaces to fill with the metallic filament substance during the process of reduction.

Dr. Kuzel has ascertained that no hollow spaces are found in the finished product, if the gases are kept away during the formation of the colloidal filaments, that is, if their contraction and glowing is made to take place in an almost absolute vacuum. As it would be difficult and expensive to fulfill this requirement in manufacture on a large scale, Dr. Kuzel (according to German patent No. 208,599) glows the filaments in an atmosphere of inert or reducing gases or vapors having a pressure of not more than 150 millimetres mercury. The best results are said to be obtained if the pressure does not exceed forty millimetres mercury. The effect is further improved if the filaments are glowed in moving gases, and for this reason the heated gases are withdrawn from the chamber, while at the same time fresh gases of as low temperature as possible are supplied to it. In order to compensate the detrimental effects of air that might enter the apparatus through small openings, a slight proportion of reducing gases is added. According to Kuzel a mixture of twenty per cent of hydrogen and eighty per cent of nitrogen gives good results; stretching the filaments during the glowing process is also of value in this connection. Kuzel states that, if the glowing of his filaments is carried out in moving gases at low pressure, it is possible to produce completely finished colloidal filaments, ready to be placed in the lamps, in one to one and one-half minutes.

B—*Manufacture of Filaments from Combinations of Fluid Substances*—According to a method of the Siemens & Halske Company described last year a plastic mass for the manufacture of filaments was obtained from acid ammonium tungstate. This firm has found that these tungsten compounds can be changed by heating below red heat in an atmosphere free of oxygen in such a way that they become conducting and insoluble in water. Filaments can be prepared from this plastic mass alone or in combination with

1 Translated and abstracted *Elektrotechnischer Anzeiger*, Berlin, October 17, October 28, and November 4, 1909.

other substances, as metallic tungsten, and by heating it to 300 to 500 degrees under exclusion of injurious gases. This renders the filament electrically conducting, so that its completion, the reduction in hydrogen or other suitable gases by means of an electric current, may be quite easily and quickly accomplished.

As already stated, the plastic mass employed in this process is prepared from acid ammonium tungstate which has to be heated in a dry state to a certain degree, which was formerly ascertained by dissolving a sample of the heated mass in water. This method was cumbersome, and the Siemens & Halske Company has found that the heating may be discontinued when a temperature of about 270 degrees has been reached. According to German patent No. 201,462 the mass heated in water is cleared and evaporated in vacuum. For this purpose a solution of tungstic acid hydrate is evaporated in ammonia, whereby acid ammonium tungstate separates itself as a white crystalline powder. This is collected on a suction filter, washed in cold water and dried gradually in increasing temperatures to 120 or 150 degrees. The product obtained is then gradually heated to 270 degrees, being continually shaken or stirred in vacuum vessels exhausted to about twenty millimetres mercury. During this operation the water and ammonia escape from the mass and the powder so obtained is put in faintly boiling water. This solution is allowed to settle and the deposit, which cannot very well be filtered on account of its fineness, is evaporated under vacuum to the consistency of a syrup and finally dried in an open vessel over a water bath. The mass must be well distributed, as upon drying it is liable to crack the vessels. A glassy, colorless, transparent mass is thus obtained which is soluble in hot water without change. In its preparation the formation of ammonium meta-tungstate $(NH_4)_2W_4O_{13}$, must be prevented as much as possible, as this salt crystallizes into large octahedrons and makes the mass unfit for good filaments. The formation of the meta-tungstate is caused by too long heating and also the admission of air during the heating.

The mass prepared by this process can be dissolved in hot water and, when it has been sufficiently thickened, be pressed into flexible filaments of considerable tensile strength, which may be transformed into solid filaments by glowing in a reducing atmosphere.

In contradistinction to the method just described J. Lux, of Vienna, prepares a binding material of ammonium meta-tungstate in concentrated solution, $(NH_4)_2W_4O_{13}$ or $H_2W_4O_{13}$, which is formed into a kneadable mass with powdered metallic tungsten, and the filaments pressed from it are glowed in a reducing atmosphere or a vacuum by an electric current.

MANUFACTURING FROM METALLIC MASSES FREE OF CARBON WITHOUT THE USE OF FLUIDS.

Interesting processes of manufacturing metallic filaments without the use of fluids have recently been developed by the Siemens & Halske Company and the Allgemeine Elektrizitaets Gesellschaft, of Berlin. Among the metallic filament lamps so far placed on the market only the tantalum lamp has filaments obtained without the employment of fluids by a dry process, namely by drawing the tantalum metal.

Last year the author described a process of the Siemens & Halske Company, which consists in tightly pressing powdered metallic tungsten or a mixture of difficultly fusible metal powders into a tube of other ductile metal, drawing or rolling it together with the latter and removing the envelope chemically, mechanically or by fusion.

This method is now employed by the same firm with other metals, chiefly thorium and zirconium, or mixtures of the same with other difficultly fusible metals in powder form. The process is said to be particularly simple and reliable, if the metal is not used as a powder, but in the form of a felty or spongy mass. Such spongy metallic masses may be obtained by using alloys of the metals in question and removing the alloying metals by solvents which do not attack the metal intended for the filament. The filaments made from such felty or spongy masses are much more homogeneous, stronger and more easily workable than those prepared with powders. In this respect spongy thorium is said to possess particularly good properties, and it may be employed alone or as a binding material for other metals that cannot so easily be transformed into a spongy mass, as metallic powders, which must be worked up with the sponge as uniformly as possible. Filaments drawn from such masses may have a skeleton of thorium, for instance, filled with tungsten molecules.

According to German patent No. 204,616, the Siemens & Halske Company utilizes powdered tungsten in connection with a very ductile metal of relatively low evaporation point in the manufacture of filaments. Silver, copper, nickel, gold and platinum are named as such metals, and they are mixed with tungsten in proportion of ten to fifteen per cent either as a powder, or they are attached chemically or galvanically to the particles in such a way, that a silvered, nickeled, coppered or gilt tungsten powder is obtained. The process of covering a conducting powder with a very thin metallic skin is well known. The coated tungsten powder is pressed into a tube of ductile metal without addition of any non-metallic binding substances, and the tube is subjected to a drawing process. The filaments produced in this manner can naturally be easily bent so long as they are enclosed in the tube. After the tube has been removed, the ductile metal can be completely driven out of the filament by sending an electric current through it in a vacuum, so that pure tungsten remains. The production of very thin filaments is said to be easy in this way.

In another method of manufacturing metallic filaments by a dry process, disclosed by the Siemens & Halske Company in German patent No. 206,142, powdered tungsten is likewise pressed into a tube of copper, silver or nickel, which has been inserted in another tube, also of a ductile metal. The ends of the tube are closed by copper plugs and it is then drawn or rolled, or first rolled and then drawn, into filaments. Steel is said to be best suitable for the outer tube, which may be removed after drawing by diluted muriatic or sulphuric acid. The remaining thin coating of the metal constituting the inner tube facilitates the handling of the filament in giving it the desired shape and is finally removed by heating in a vacuum or an atmosphere of hydrogen by means of an electric current. When the temperature has become sufficiently high, the evaporation of the envelope begins at one place and spreads in a short time over the entire surface, leaving the finished tungsten filament.

In order to carry out the process a drawn steel tube fifty millimetres in length, with an outer diameter of eight millimetres and an inner diameter of four millimetres, may be employed. The inner tube of copper, silver or

nickel used in this case should have an outer diameter of four millimetres and a wall two millimetres thick. The reasons for using a double tube are not stated by the firm, but this has probably been found necessary in order to prevent the breaking of the envelope during the rolling or drawing process.

The manufacture of metallic filaments is the more difficult the thinner they are to be. In order to produce still considerably thinner filaments than practicable by our present mechanical means, or in order to reduce filaments that have turned out thicker than intended for some reason or other, the Siemens & Halske Company treats them with phosphorus vapors. The finished filament is heated to a high temperature in phosphorus vapors of low pressure, if necessary in the presence of diluted gases, as hydrogen, whereby its thickness is said to be diminished with great uniformity, so that serviceable filaments of any cross section may be obtained. The phosphorus is said to cause the formation of phosphoric tungsten on the surface of the filament, which is evaporated on acount of its low melting point. For this purpose the filament to be reduced is placed in a receptacle that is joined to a vacuum pump, and connected to a source of electric current. A little phosphorus, for instance in the form of a solution in bisulphide of carbon, is put into the receptacle on an asbestos board, then the air and bisulphide of carbon are displaced by hydrogen and the receptacle is exhausted. The filaments are brought to a bright red heat by the electric current until they have decreased to the desired thickness, which may be determined by the change in their resistance.

In a similar manner the Allgemeine Elektrizitaets Gesellschaft, of Berlin, produces filaments from tungsten, molybdenum or other metals of high heat-resisting qualities. The method consists chiefly in preparing a mixture of the best heat-resisting metal or metals with copper or one or more other easily fusible metals, and working the mixture into filaments. These are heated to a temperature sufficiently high to cause the less resisting metals to evaporate, so that a conductor of the pure filament metal remains. For this purpose finely powdered molybdenum powder, for instance, is thoroughly mixed with a quantity of copper of equal weight, and the mixture is transformed by high pressure into a solid body, which is heated to such high temperature that the copper melts. From this mass filaments are rolled or drawn and heated in a vacuum or in hydrogen in order to drive the copper out of them. After the evaporation of the copper, completely pure molybdenum filaments well suited for incandescent lamps are said to remain.

A cadmium alloy is used as a binding material in the same manner, an alloy of bismuth and cadmium being particularly suitable, as it melts at a very low temperature. If a tungsten filament, for instance, is to be produced with the aid of a bismuth-cadmium alloy, pure tungsten is first transformed into a colloidal solution in order to obtain it in the form of a fine powder, and then the solvent is evaporated. The bismuth-cadmium alloy may be prepared by smelting these substances together over a gas flame or otherwise. Good results are said to be obtained by melting 208 parts in weight of bismuth and 112 parts of cadmium, giving an alloy which corresponds to the formula BiCd. This alloy is heated until it becomes plastic and is then mixed with the powdered tungsten, advantageously in a proportion of fifty-three per cent in weight. A mortar may be used for the mixing. The mass is pressed into filaments under application of a low heat. All substances incapable of resisting a high temperature are then driven from the filaments by heating them in a vacuum or indifferent atmosphere. After the evaporation of the alloy the filament is heated to a very high temperature by increasing the current in order to sinter the tungsten particles and obtain a good filament.

The latest methods of manufacturing metallic filaments, as will be seen, aim at replacing the fluid by metallic binding materials, and the time is not distant when it will be possible to draw filaments of difficultly fusible metals with the same facility as copper wire, for instance, and to preserve them rolled on spools, like the latter. The greatest difficulty at present consists in producing extremely thin filaments, but nevertheless most firms have succeeded in equipping sixteen candlepower lamps with tungsten filaments for pressures up to 130 volts at a specific consumption of about 1.25 watts per candle, and twenty-five candlepower lamps are furnished for pressures up to 250 volts.

In order to increase the quality, reputation and manufacture of metallic filament lamps future efforts should aim not only at improving the ductility of the filament, but also at diminishing its length; in other words, at increasing its resistance without lessening the efficiency. It will then not be necessary to produce filaments of impossible thinness and the great breakage, which in large works now amounts to several hundred thousand a week, will be reduced to a small proportion, and the manufacturing costs will be very considerably lowered thereby.

Tesla's Plan for "Wireless" Electric Lighting.

In a recent newspaper interview Nicola Tesla is reported to have said that as the result of many years' effort his "wireless electric light" has practically been brought to a state of perfection, and a plant for its production is now nearing completion at his laboratory.

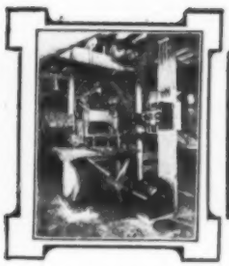
"It would be possible by my powerful wireless transmitter," said Mr. Tesla, according to this account, "to light the entire United States. The current would pass into the air and, spreading in all directions, produce the effect of a strong aurora borealis. It would be a soft light, but sufficient to distinguish objects.

"My present plan is to distribute this light from a central station, which is the most economical and also the best method of obtaining light of highest quality. My lamps will last forever, there being nothing in them to burn out. They are simple tubes or bulbs of glass hermetically sealed and containing nothing but rarified gas.

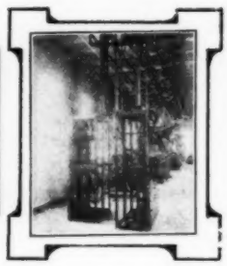
"One advantage is the economy of production which is greater than in any other light so far obtained. A great saving will be effected by wireless distribution. I am intending chiefly to supply isolated dwellings which cannot be conveniently reached by wires, and in this system of distribution there is absolutely no difference where the dwelling is located. The force of the current is the same whether the house is 12,000 miles from the plant or twelve feet."

Illuminating Engineering Society.

The annual business meeting of the Illuminating Engineering Society will be held at the Engineering Societies Building in New York city on January 14. The regular monthly meeting for January will be held at the same place on January 20.



Industrial Power



ELECTRICALLY DRIVEN PUMPS.—I.

OPINIONS, EXPERIENCES AND PRACTICE OF MANUFACTURERS AND USERS.

The most vital problem to managers of electric-generating stations is that of providing a day load approximately equal in amount to the evening peak load due to electric lighting, which latter is the raison d'etre of most central stations. This lighting load of itself is not remunerative as a general rule, for, as is well known, practically the same amount of capital must be sunk in generating equipment, etc., to supply current for the few hours during which electric light is needed as would be the case if the same amount of current per hour were to be used during the whole twenty-four hours of the day. Maintenance and depreciation charges, wages, etc., are other important items which are standing charges not materially affected by the kind of load. Thus it behooves the central-station man to find other outlets for the sale of his current which will increase his load factor, that is, which will enable his plant to operate as nearly as possible up to its maximum efficiency and output during the whole day.

One of the most important fields of activity in this direction, and one which will well repay investigation and exploitation, is that of electric pumping. There is not a city, town, or municipality of any size, where pumping of some kind or other does not furnish a large load, and in most cases this load is of a very profitable kind and is especially adapted for electrical operation. There are, indeed, very few cases in which the electric motor is not better adopted for pumping than the steam engine or other forms of prime movers.

A few opinions of manufacturers are given below, not the least interesting being the first of those cited:

THE DEANE STEAM PUMP COMPANY, HOLYOKE, MASS.

"We have made and are making constantly a great many motor-driven machines, and in general we can say that the motor-driven power pump will show a very decided economy over the old direct-acting steam pump which was formerly used for the service when the motor-driven pump is now used. . . . In some cases no other type of drive would be possible.

"CHARLES L. NEWCOMB,
"General Manager."

FORT WAYNE ENGINEERING AND MANUFACTURING COMPANY, FORT WAYNE, IND.

"We have developed a very successful pump for direct-connection with motors. . .

"The most suitable pump from the point of view of the electrician is, of course, the centrifugal or some kind of rotary pump, because here the starting torque is small, the running torque uniform, and the speed high. From the point of view of the hydraulic engineer a pump with a positive displacement is always preferable and often imperative, both because the quantity of water is reliably constant and the power consumed invariably is less.

"In order to make a positive piston pump that will meet successfully the conditions of electric drive it should be made as nearly as possible to act as a centrifugal pump. For this reason the design is very important and should be such as to allow the pump to run at high speed. It must be double-acting, and the difference between the greatest and smallest torque should be as small as possible. The flow of water to the pump should be smooth and straight so as to avoid turning as much as possible. . . .

"We have succeded in developing a piston pump to meet these conditions of electric drive in a very satisfactory manner. . . .

"We wish to add that the vital point in the motor for this class of service is the starting torque, and for the reason the motor with the greatest starting torque is always preferable. So is the motor running at a high speed, as such motors accumulate a greater amount of inertia and counteract the variable resistance furnished by the pump.

"JOHN ASTROM, Chief Engineer."

ERWIN AND COMPANY, CHICAGO, ILL.

"Regarding the features possessed by electrically-driven pumps and not possessed by steam and air pumps, we take pleasure in replying that we could write nearly a book on this subject. . . .

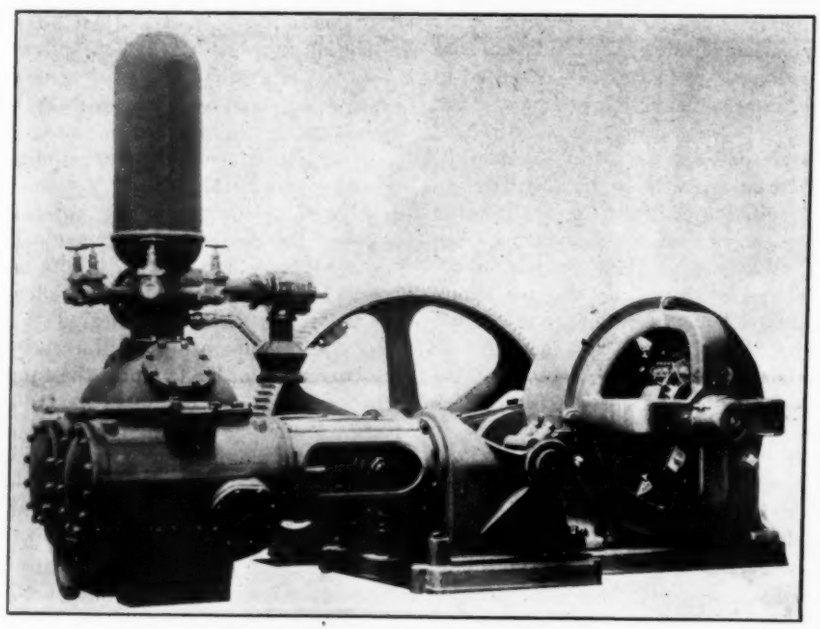


FIG. 1.—DEANE UNDERWRITERS PUMP.

"The experience we have had during about twenty years of manufacturing and installing electric pumps in Chicago and throughout the country has confirmed us in our opinion that these are the most efficient, economical and satisfactory styles of pumping machinery. Our experience has been that the triplex, centrifugal, rotary and double-acting duplex are all well suited to electric drive. "J. A. ERWIN, M. E."

THE GOULDS MANUFACTURING COMPANY, SENECA FALLS, N. Y.

"The question of arranging pumping machinery for electric drive is a very simple one and the pumps which we manufacture are furnished largely for this method of

drive. This will apply to all kinds of pumping work, such as general water supply, tank pumping, boiler feeding, hydraulic elevators, fire pumps, pumps for handling chemicals, brine and ammonia in cold storage and refrigerating plans, papermill stuff pumps, suction pumps, shower and pressure pumps—all of which are being used largely in connection with electric power.

"We have been for some time giving special attention to electric-driven mine pumps. Here is a situation where there is no question about the electric-driven pump being

"For pumping water out of deep wells the power pump has many advantages over the fast-disappearing direct-acting steam pump. The question of economical operation is one which enters largely into a problem of this kind.

"The comparative cost of operation may be very closely approximated by determining the cost per horsepower-hour of the electric current delivered to the motors, with the amount of steam used by the direct-acting steam pumps. In some cases the quantity of steam consumed is simply enormous and on certain installations where electric-driven triplex pumps have been put in to replace steam pumps, the saving effected has been enough to pay for the difference in price in a couple of years' time. Bear in mind also that after these electric pumps have been paid for, this saving is all profit and adds very materially to the profits.

"It is easy to see that the labor involved in operating electric-driven pumps represents a very small item indeed. Where electric power is purchased from some central station, it is simply a question of throwing on a switch and giving a little attention occasionally to the oil cups and packing glands of the pump. In some cases the pumps are arranged so that they operate automatically by means of electric stop-and-start apparatus, and in one particular plant we have in mind where the pumps are provided with automatic oiling device, the pumping station is sometimes locked up three or four weeks at a time. This minimum amount of attention required certainly argues much in favor of electrical pumping.

"F. T. WELLS."

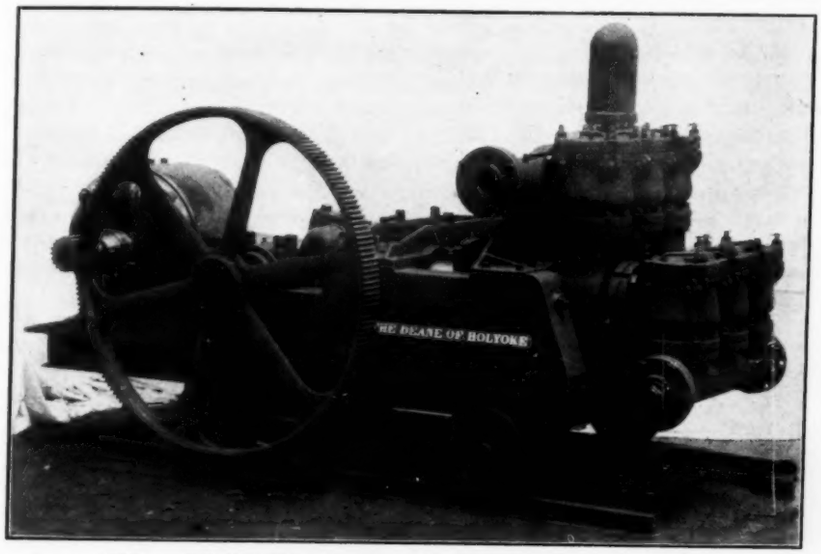


FIG. 2.—DEANE TRUCK PUMP FOR UNWATERING IN MINES.

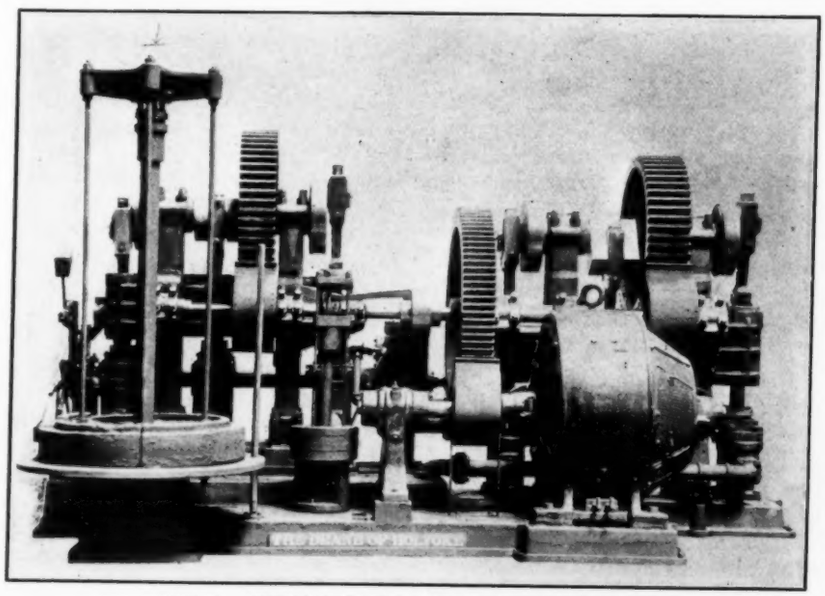


FIG. 3.—AUTOMATIC PUMP AND CARTRIDGE PRESS.

superior to any other possible type that can be used. The field is practically unlimited and it is a remarkable fact that it is possible to do away with the long lines of steam pipes made necessary where direct-acting steam pumps are used in mine service, which will at once show the possibilities of electric pumping in connection with this mine work. Another point is that the pumps may be located in certain convenient sections of the mine, where it would be out of the question to mount a steam pump.

THE WEINMAN PUMP MANUFACTURING COMPANY, COLUMBUS, OHIO.

"We manufacture quite an extensive line of electric motor-driven pumps for a variety of services. It would be a difficult matter to attempt to make a comparison of the operating expenses of an electric-driven pump, as compared with steam-driven, owing to the great variation in rates charged for current, as well as the great variation in cost of the production of steam in different plants.

"The electrical-driven pumps are practically well adapted for mine use on account of the great loss in power unavoidable in long steam lines. Not only this, but it is a simple matter to make this installation automatic, and in this manner consume the power only when it is actually needed.

"Next in importance is the demand for an automatic water supply for suburban residences, which are not reached by the municipal waterworks systems, and this is a feat which cannot be accomplished in any other way. We have confined our line so far as general service pumps are concerned to the single-cylinder double-acting variety and our experience with this type has been very gratifying. The great advantage of this type over the others is that the liability for an excessive overload on the motor due to friction is much less than in other types.

"W. ESSINEAU."

RUMSEY AND COMPANY, SENECA FALLS, N. Y.

"Triplex pumps are particularly applicable for electric drive because the combined efficiency of the pump and motor is higher than that of any other pumping unit when working against full load, and the tendency in the use of pumps driven by electric motors is increasing every day.

"G. W. HALL, Advertising Manager."

HENRY R. WORTHINGTON, NEW YORK, N. Y.

"The centrifugal pump is rapidly gaining favor and is now employed in practically all conditions of pumping.

"H. J. MEEKER."

D'OLIER ENGINEERING COMPANY, PHILADELPHIA, PA.

"We have found the field for motor-driven centrifugal pumps extremely broad. Not only is the centrifugal pump suitable for handling so small a quantity of water as twenty-five gallons per minute against either low pressure or as high a pressure as 150 pounds, but it is also thoroughly well suited to delivering a large volume of water against either high heads or low heads. Where electric current is available at a satisfactory cost of production, the electric motor and centrifugal pump form an ideal pumping unit, being not only efficient, but simple in construction and operation, and requiring very few repairs and very little attention.

"H. D. HUFF, Secretary."

TYPICAL INSTALLATIONS.

Some typical installation of electric-driven pumps are described and illustrated below:

Fig. 1 shows a rather notable development of power-pumping machinery,

being an outfit built in accordance with the searching requirements of the Fire Underwriters' Association. That the underwriters will permit the installation of a motor-driven pump is a strong guarantee of the safety and efficiency of this type of pump.

Fig. 2 is an illustration of a power pump recently installed by a large coal-mining company. This truck pump is used in unwatering a coal mine where the seepage is very rapid and where a stoppage for repairs would prove extremely dangerous. The manufacturers assert that this type of pump has entirely superseded the old direct-acting compressed-air pump formerly used in these and in many other mines.

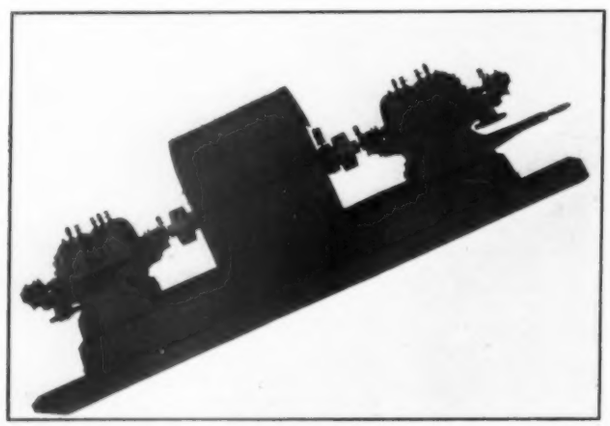


FIG. 4.—CENTRIFUGAL PUMP INSTALLED ON INCLINE IN MINE—MOTOR COVERED.

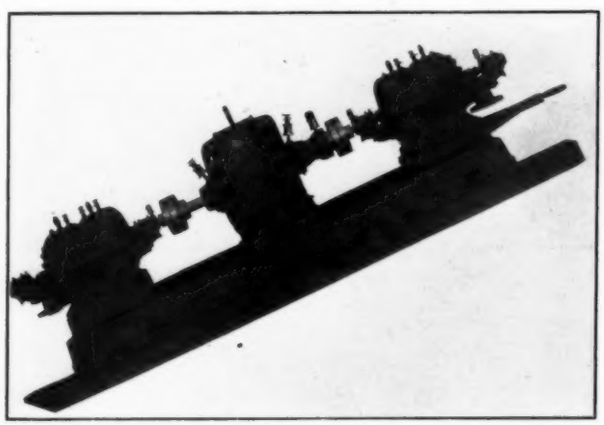


FIG. 5.—CENTRIFUGAL PUMP INSTALLED ON INCLINE IN MINE—MOTOR UNCOVERED.

Fig. 3 shows an interesting equipment supplied to one of the United States Navy Yards, to replace a massive compound crank-and-flywheel pumping engine. This pumping unit automatically supplies water at varying pressures to a cartridge drawing press and has been found to increase the output of the press and reduce the cost of operation to a considerable extent.

All three of the above-mentioned installations were furnished by The Deane Steam Pump Company, of Holyoke, Mass.

A somewhat unique application of electric driven mine pumps is illustrated in Figs. 4 and 5. These views show two centrifugal pumps, driven by one motor, which are in use on a steep incline in a gold mine. The pumps are piped so as to operate in series, thus adding the pressures produced by each pump; or the flow of water can be so directed by means of valves in the piping that the delivery of the outfit will be the combined capacity of both pumps against the pressure of one pump. The motor is a Westinghouse alternating-current machine, running at 1,700 revolutions a minute. The pumps, which are by the D'Olier Engineering Company, of Philadelphia, Pa., have a capacity of 160 gallons per minute against a total head of 280 feet. These pumps are divided on a horizontal plane through the middle, thus permitting the upper part of the case to be removed without disturbing the piping connection or bearings. This feature renders the operation of inspection and cleaning a matter of only a few minutes. If the bearing caps and the coupling are disconnected, in addition to removing the upper half of the pump case, the whole of the running parts of the pump can be removed.

(To be continued.)

English Railroad Company to Install Electric-Driven Cranes.

The North-Eastern Railway Company, of Great Britain, is projecting considerable extensions to its Darlington works, in which a number of high-powered electric-driven cranes will probably be installed. Electric power will also be used to a great extent in those proposed developments.

Electric cranes are being developed to a great extent in England, where some striking installations have recently been made.

N. Y. Interborough Orders Steel Cars.

The Standard Steel Car Company has received a contract for the building of forty steel cars for the subway of the Interborough Rapid Transit Company of New York.

Power from Windmills.

An interesting article by W. P. Gerhard, entitled "The Power Developed from Windmills," with several formulas and tables, appears in the December issue of the *Engineering Review*, of New York and Chicago. The author's conclusions are as follows:

"While the foregoing considerations point out conclusively the fact that the horsepower developed by the smaller wheels under an average wind velocity is but small, we do not wish to be understood as underrating the many advantages of windmills. They have without doubt a very wide field of utility on the farm and for country estates, not only for pumping water, driving dynamo machines to charge electrical accumulators or storage batteries, for compressing air (the larger sizes only), but also for driving light farm machinery, for shelling corn, cutting feed, running sawmills and other work of a nature admitting of a suspension during a calm.

"Windmills enable the farmer to obtain motive power at the least possible cost, for the wind power is free to all, costs in itself nothing and is obtainable anywhere. In this respect it is superior to water power, which is not everywhere obtainable, and where available, though free, requires considerable expenditure in the construction and maintenance of dams and conduits. The mechanism required to utilize the wind force is also cheaper than hydraulic power apparatus.

"The only drawbacks are the irregularity and uncertainty of the wind, yet, according to a report of the United States Weather Bureau, a sixteen-mile wind may be expected on the average during one-third of the year."

Marine Propulsion by Electric Motors.[1]

Before the introduction of electric transmission the marine engineer had the more complete scientific data, and consequently the marine engine held the blue ribbon of economy which now belongs to the turbo-electric generator. Among the reasons for the higher efficiency of the land turbines are: That the engineer on land is freer than is the marine engineer to adopt a suitable speed of revolution; that the land turbine runs at approximately constant speed for all loads, and can therefore be run on the governor, rendering easier the application of superheat and augmented vacuum; that on land it is possible to subdivide the power units to meet the conditions of varying load, and thus maintain at the smaller loads an efficiency not materially different from the efficiency at the full load of the system; that the sea change of power is directly associated with change of speed, and the whole of the power units must always be in motion while the ship is in motion. The same engine has to run the ship at ten knots and at twenty knots, although the power varies very widely between those limits. Also the high economy on land of power production associated with electric transmission is largely due to the possibility of exact measurement of power under all conditions of load, thus giving a complete knowledge of the effect of all changes in the apparatus or in the methods of working it.

The proposition here made is to provide an electric equipment intermediate between the prime mover and the propeller, extending the limits of practical economy in each by modifying the restrictions which the prime mover and the propeller impose upon one another, and providing that the prime mover may operate at or near the constant speed required for the attainment of maximum efficiency and full power, and that the power expended in driving machinery not required for work is reduced to a minimum or entirely eliminated. At full power all the elements of the generating plant are in full operation and the whole power resources can be concentrated on driving the ship. When full power is not required the generating plant may be shut down in sections.

To accomplish these ends special motors have been designed which give the necessary changes of speed and direction and permit of the advantageous combination or elimination of the power generators. These motors involve no new electrical principle, but simply mechanical adaptation of well-known electric designs. Alternating current alone is available for the purpose in question, and normal motors have therefore a fixed speed of rotation which is a simple multiple of the generator speed.

Two methods of speed change are proposed each associated with a new form of motor.

The principle of operation of the "spinner" motor is that an ordinary normal motor driving the propeller at a fixed speed, with the shaft and propeller directly connected, is so arranged as to be rotable as a whole about the propeller-shaft axis. This rotation is accomplished by a second motor concentrically arranged outside the first, so that the main motor system may be rotated in either direction— again at a fixed speed which is a simple multiple of the generator speed—and the speed of rotation of the propeller shaft and of the propeller in the water is the algebraic sum of the rotation of the main motor and of the rotation imposed upon it by the auxiliary motor.

As both motors are reversible it will be seen that in each direction there are three speeds: (1) The speed of the main motor system: the middle speed. (2) The speed of the main motor system minus the speed of the auxiliary motor system: the low speed. (3) The speed of the main motor system plus the speed of the auxiliary motor system: the full speed.

The combination may be designed for any three-speed ratios, such as one, two, three; two, three, four, etc. Any intermediate speeds required are attainable by adjustment of the turbine or engine governor, which can be operated economically through a range down to about seventy-five per cent of full speed. The same method is applicable to non-reversible internal combustion engines.

The "multiple" motor is an ordinary squirrel-cage induction motor in all respects, except that its stator is wound with two or more independent electric circuits each associated with a separate source of supply of energy. For example, the motor may be fed from two sources of supply at twenty-five to fifty periods respectively, the motor windings being for forty-six and ninety-two poles. At full power and speed both windings are in operation under their most advantageous conditions; each of these windings results in a synchronous speed of sixty-six revolutions per minute. When the twenty-five period current is supplied to the ninety-two-pole winding the speed is thirty-three revolutions per minute.

Either of these motors permits of one or more generators being used together in the same mechanical system without electrical connections or synchronizing devices.

Typical examples are as follows:

In a cargo vessel of 840 shaft-horsepower the normal reciprocating engine equipment with a single screw would weight 570 tons for engines, boiler and fuel. The electrical equipment, consisting of three oil engines, three motors and three propellers would weigh only 270 tons, including fuel. Further, with coal at $5.00 per ton and oil at $10.00 per ton the saving in fuel cost on a total of $85.00 would be $26.50 per day at full power.

In a similar cargo vessel, gas engines might be used. Taking an equipment of 770 shaft-horsepower, and using three gas engines and one multiple motor, the respective weights of the normal and proposed equipments would be 446 tons and 229 tons.

A third cargo vessel, but of 1,030 shaft-horsepower, is worked out for the purpose of illustrating the application of steam turbines to the multiple motor. One plant drives the ship under normal conditions: extra power is supplied by a small turbo-generator, and is used to keep up the ship's speed in heavy or contrary weather.

On a passenger vessel of, say, 16,200 shaft-horsepower, the electrical equipment permits of a subdivision of the plant, so that at ship speeds lower than the maximum only part may be run, and that at full power. This advantage is gained without loss in full-power economy, and without complication.

1. Abstract of a paper by H. A. Mavor, presented at a meeting of the Institution of Civil Engineers, in London, December 7, 1909.

Railway Sale Postponed.

The foreclosure sale of the property of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company has been postponed to March 1, 1910, by an order signed by Judge Lacombe in the New York United States Circuit Court. The date was originally fixed at February 1, 1910. The change was made to give the Public Service Commission more time to consider the proposed reorganization.

A Safe Method of Firing Shots in Mines by Electricity.

A paper of unusual interest to electrical engineers, says *The Electrical Engineer*, of London, England, was read on Saturday, December 11, before the North of England Institute of Mining and Mechanical Engineers at Newcastle-on-Tyne, by James Douglas, on electric simultaneous shot firing from a switchboard outside the mine. This has been advocated as an absolute safeguard against loss of life, although the risk of fire and of explosions of coal dust through mis-shots, still remains. A description of its application at Dawson, New Mexico, obtained from David Crow, the General Superintendent of the Stag Canon Fuel Company, was given.

Speaking generally, this consisted of making use of the electric trolley wires in the mine for electric shot firing from a special station outside the pit by means of suitable tappings and special switching gear. The firing is done after all the men are checked out of the mine, and as the pitmen work from 7 a. m. to 5:30 p. m., and no work is done for an hour and a half before the shots are fired, it is possible to make sure by personal inspection that all the men are really out of the mine.

In connection with the firing system, a wireman or firer and two fire bosses are employed. The former has to see that all the pitmen are out of the mine and that the power is off before he connects up the firing circuits to the various rooms. He has also to make sure that all the firing circuits are disconnected from the power lines after the shot has been fired; to see that the wiring is kept up in insulation, and that the miners are furnished with wire for extensions. Where workings are abandoned, he has also to see that the wiring for shot wiring is removed.

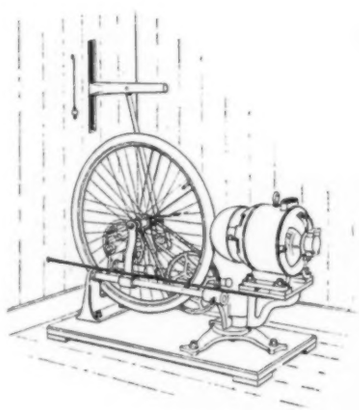
The actual firing is done about 7 p. m., and after this he has to enter with a safety lamp and disconnect the switches, looking to see if there are any indications of fires in the mine. The fire bosses enter the mine at 3 a. m., examine the districts, and are out in time to inform the men as to the conditions of their working places. They also distribute electric caps and examine all the shot holes in their districts before they are charged. The explosive is fired by means of six-feet reliable exploders, clay being employed for tamping.

At the point where the firing line is tapped on to the trolley wires there are two switches, one being in a box interlocked and keyed, so constructed that it cannot be closed and locked when the switch is thrown in, the other being open and auxiliary. There is another set of switches inside the pit mouth between the outside and the inside trolley wires. Another set is located outside and inside the feed wires, and a third between the outside feed wire and the wire to the shot firers' cabin. The main switch by which the firing is done is in the shot firers' cabin.

This paper, *The Electrical Engineer*, adds, is doubly interesting as being read at a time when electricity is being looked upon with suspicion as applied to mines, inasmuch as it demonstrates that in this connection, at any rate, the use of electricity is a positive life saver.

An Electric-Motor Attachment for Organ Blowing.

The ingenious device illustrated herewith has recently been introduced by an English concern for electrically



THE ELECTRIC ORGAN BLOWER.

driving an organ originally equipped with the old-fashioned hand-lever blower.

In this unique arrangement, the hand lever is coupled to a pitman rod and crank, the latter being driven from an ordinary bicycle wheel. The rubber tire of wheel frictionally engages with a hemisphere of polished aluminum which is direct-connected to the armature shaft of a one-half brake-horsepower, shunt-wound, constant-speed electric motor. The wear on the tire is said to be very small, as the slip is negligible in amount.

A noteworthy feature of the design is the arrangement for providing a variable speed. This is effected by mounting the motor on a swiveling carriage which can move tangentially to the tire, so that in every position the hemisphere is in contact with the latter, the gear ratio varying from zero in the position shown to a maximum when the motor is turned through a right angle, with perfectly smooth gradations. The carriage is rotated by a cord connected with the bellows, so that the speed is highest when the bellows is nearly empty. Ball bearings are used throughout, so that the running is practically inaudible, and the parts are all standard cycle fittings. The floor area required is forty-five by sixteen inches, and the height thirty-three inches.

Electric Galvanizing.

In a recent issue of *The Electrical Engineer*, of London, England, the German correspondent of that paper, writing from Berlin, makes the following interesting remarks on the subject of electric galvanizing:

It is obviously important to galvanize as rapidly as possible, and for this purpose strong currents are used. They have the drawback, however, that the electrolyte at the cathode becomes so dilute very quickly that the deposition is made useless. The same trouble occurs at the anode, less quickly, it is true, but fast enough to cause great inequalities in the thickness of the metal laid down. Stirrers working in the liquid are a remedy to a certain extent, but do no more than mitigate the evil.

Herr Maximowitsch has found that the trouble can be completely removed by having the electrodes lying horizontally, with the anode above the cathode. When this arrangement is adopted the stronger liquid around the anode sinks and enriches the weak liquor around the anode. In fact, the cell is made to stir itself and does so for nothing, and more effectually than solid stirrers which cost money to provide and drive. A silk cloth is stretched between the two poles to catch fragments which may become detached from the anode. Excellent results are got with a solution of 250 parts by weight of copper sulphate crystals and twenty-five of concentrated sulphuric acid in 1,000 of water, using a current density of from six to ten amperes per square decimetre. The distance between the electrodes should be eight centimetres and the potential 0.8 volt.

ELECTRICAL Advertising *and* Selling

INCREASING CURRENT CONSUMPTION WITHOUT INCREASING "KICKS."[1]

BY CHARLES A. PARKER.

Increasing current consumption without increasing "kicks" emphasizes a fact which cannot be too clearly recognized, namely, that the up-to-date central station is selling and wants to sell service and not current.

The man who quarrels with this statement may as well put aside this article as there is absolutely nothing in it for him.

The man who admits the truth of this statement admits also that it means a very considerable moral responsibility resting on his shoulders and strenuous efforts a-plenty on his part before he can live up to the duty he believes he owes the public.

For, as surely as he attempts to "sidestep" responsibility and take the easier paths, by holding back from public knowledge the "new things" as they are brought forth, so surely does he commence to undermine the foundation of the public's confidence in his sincerity and belittle his standing as a good merchant.

Too much stress cannot be put on this parallel between the central-station man and the "merchant" because the nearer we can come to making the terms synonymous the nearer we approach to a condition which is ideal.

One great trouble with central stations roused to activity by oratory and co-operative rebuke has been the tendency to switch with altogether unjustifiable suddenness from "octopian graspingness" to "altruistic philanthropy."

A merchant uses a considerable amount of common sense and shrewdness in deciding what goods he will "mark down" for eye-catchers and what goods he will hold back to show special customers whom he knows will pay a good price for a good thing.

The point is that while central stations want to be good merchants and give the public good service, they should not overlook profits.

What will it profit a central station to announce that a marvelous new electric lamp cuts the light bills into microscopic fractions if the result is to disturb his connected load?

Rather let him judiciously, and with something of the merchant's shrewdness, go forth into those highways and by-ways where dwell the non-users of electricity, and direct his cannon against the kerosene can, and his artillery upon the hosts of the gas man and his cohorts.

Thus building up an increase of load against the time, when, as will necessarily follow, those who are already enjoying electricity will "get up on their hind feet" and demand to be let in on "this new thing of which we have heard."

ELECTRICAL HEATING DEVICES.

A fruitful method of "increasing current consumption without increasing kicks" is by the proper, well-considered introduction of electrical devices of all kinds.

Thousands of articles, papers and exhortations have been written on this subject, it is true, but, when you come to think of it, has enough emphasis been given to the merchantly point of view?

There have been free offers, free trials, a pound-of-tea-with-every-iron, coupons, voting ballots, etc.

There have been wonderful advertising schemes, solicitors, hand-books, text-books, coach-books, and what not, many of them distinctly worth while. What there has not been is enough of the spirit of the best type of shrewd, judicious merchant.

The first thing a good merchant tries to do is to thoroughly acquaint himself with the goods he has to sell, his stock in trade. On the other hand there have been too many cases of central stations flooding a community with enthusiasm for electrical devices only to let the enthusiasm die away through the absolute neglect, ignorance and unreadiness-to-serve of the central-station people themselves.

The spirit of one man whom the writer met in the course of his travels is what is needed.

He had bought an electric iron of all makes and had succeeded in getting a thorough test of every one of those irons during a period of several weeks in order to ascertain which did the best work.

He also experimented, personally, by placing the irons on pads of paper for varying lengths of time, carefully tabulating the results and marking the exhibits, recording the point-hotness, etc. He finally selected an iron of a different make than that which he would have chosen had he been guided by the general attitude of the other member-companies of the syndicate to which he belonged.

The result was that the people of that city got a good iron, repairs were standardized, the whole office force was made thoroughly familiar with the iron, could demonstrate it, and there was a degree of unanimity of satisfaction in the use of electric irons in that city which very few cities indeed have enjoyed.

Once having familiarized yourself, your force, and a few well-chosen personal friends with such electrical devices as you have deided can be profitably placed on your circuits it is apparent that the season of advertising and exploiting these devices is now at hand.

A STATEMENT OF THE CASE.

Taking up the problem itself now, it may not be a bad idea to adopt the procedure of our brethren of the legal profession and "state the case."

In its briefest possible form it is a case of original cost plus expensiveness of operation against the advantages and economies of electric appliances with the central-station man pleading the cause of the latter.

Of course it is quite unnecessary to elaborate upon the merit of the central-station man's side of the matter. In fact, were the matter really reduced to the exact terms with which we state it, there would be little trouble. The fact that the ideas of your prospect

1. The third of the present series of articles on "Central Station Advertising" appearing in the second issue of each month.

are not well-defined complicates the situation very much. His notions of the expense connected with electrical utensils are vague, prejudiced, exaggerated, varied, and whimsical.

Central station advertising must proceed along certain general lines that experience has demonstrated to be correct, after which, wherever success has not crowned your efforts, individual prospects must be met on the ground of their own ideas by the solicitor and won over if they are to be won at all.

In the first place, of course, prospects must be made to want the electrical devices you are pushing. This is not as difficult a matter as some others. Generally a good strong comparison of "the electrical way" of doing things is sufficient to install a good, healthy element of desire.

This part is a much more simple matter than that of convincing the prospect that neither the expense of the article in question nor the cost of operation are legitimate objections to its use. It is a hard thing, in any case, to convince the ordinary human being to make a present sacrifice for a future good.

But it can be done. Nurse along the germ of desire you have created until it rises in rebellion against the "penny-pinching" side of his nature. At the same time that you are nursing this desire, overcome his reluctance to undergo the necessary expense by emphasizing the fact that the cost of electrical utensils can in no way be equaled by their advantages and economies.

ADVERTISING PLAYS BY NO MEANS THE LEAST IMPORTANT PART.

Of course it sells goods directly. Perhaps it is more effective in this respect when applied to the sales of electric utensils than it is in any other branch of central station activity. Nevertheless this is not its most important work. It acts even more effectively as an advance guard for the solicitor, gaining a hearing, settling doubts, and making explanations that would otherwise occupy much of his time. In this way, the solicitor can cover much more ground than would otherwise be possible.

Advertising should also act as first aid to the display and salesrooms. It should arouse interest in the central station's exhibits and, if this point is persistently played upon, it will result in bringing the prospect into the office where he will become fully acquainted with the "life electrical."

As true as all this is, the chief work of advertising is still to be mentioned. It is, in the main, an educator and a missionary. It makes prospective buyers familiar with the various articles which would otherwise be practically unknown. It prepares the soil for the harvest. Few people buy an article the first time they hear of it. When, however, they find that it is being brought to their attention in a hundred different ways their innate curiosity impels them to investigate. And investigation is an essential preliminary to buying.

To say that advertising of the right sort will have a certain effect is one thing. To tell how to prepare that advertising is quite another, even if one is able to do it himself. Much that we have suggested in previous articles would be quite in point right here but space will not permit of details.

The successful advertiser of electrical utensils must fully understand and be in complete sympathy with the psychology of womankind. For it is to women he must in the main address himself. He must recognize woman's attitude toward the housework and toward the family first.

Never fail to consider the effect of example and suggestion upon the feminine mind. If her friends, here and there, begin buying electric flat irons she will buy one also. For this reason fifty irons scattered over a town have a pulling power that fifty irons in a single neighborhood lack.

When it comes to the question of expense, it will take stronger and more pointed talk to get action out of the economical woman than it will to arouse her desire. Actual figures are convincing but actual experience is better.

This is why trial offers are good. For this purpose, the flat iron can be used as the entering wedge. When a woman finds that its use is a delight she never knew and that the resulting bills do not lead to bankruptcy, she will come round for other utensils.

THE ACTUAL ADVERTISING.

When we come to a discussion of the actual advertising, the writer's predelection for mail advertising is too well known to need any comment.

This, however, does not mean that other forms of advertising are not effective. Any form of publicity that gets your matter before the people in a strong, effective manner is good advertising. And to this end, every means available should be used. Newspaper, street car, billboard, window display, novelty, etc., are all good, provided the bulk of the work is done through the mails. It might be well to adopt the motto of one progressive central station, "Let no opportunity escape."

Of equal importance with the means of advertising is the time. Great attention must be paid to seasonable advertising. The psychological moment must be seized "e'er it flies."

BEING SEASONABLE.

It would be poor policy to talk "fan" for January or allow the holiday season to go by without a word on anything. But seasonableness in advertising should be carried out to a much more subtle degree than this. An effort should be made to advertise each article at the very time when the appeal will be strongest.

The lines along which adertising shoud be written have been described too often to need repetition here. All good advertising procedes in much the same way. An effect is made to catch the eye. That done the interest must be aroused and carried along to the desired conclusion.

The ability to do this, of course, largely depends upon native talent, a knowledge of the people to whom the advertising goes, and an accurate knowledge of the articles to be advertised. The fact that this is a problem of writing for women has made feminine advertising writers peculiarly successful in this field. They write from the standpoint of a woman.

Of course, not knowing the previous successes and activities of different central stations, it is quite impossible in a general article of this kind to outline an actual campaign even if that were desirable. Here, however, are a few ideas, the success of most of which can be vouched for by experience:

One central station found that its solicitors spent most of their time trying to induce people to accept flat irons on trial. The actual results were small. So they adopted, with signal success, the plan of sending an iron to carefully selected parties stating that the solicitor would call in a few days to give a demonstration. This always resulted in some sort of a hearing and increased sales considerably.

Another company makes a business of loaning an iron for a number of months. At the end of that time, it is willing to guarantee it for a year from the date of the expiration of the loan and sell it at a special rate. Need-

less to say, very few people who accept the loan refuse to buy the iron.

Here is an idea that has met with success: The central station issues invitations to various Ladies' Aid Societies to accept its offer to supervise an "Electrical Luncheon." When a society accepts, the company supplies a demonstrator and a series of electric utensils. Then, using the utensils under the directions of the demonstrator the ladies serve lunch at a social, turning the proceeds to the church. The demonstrator takes advantage of the opportunity to explain the various articles and to take orders. The effectiveness of such a stunt can be doubled if a fair percentage on each order is turned over to the church.

Central stations in small towns will find it advantageous to hold electric shows for periods long enough to give everybody an opportunity to get acquainted with electrical devices but not so long as to allow interest to lag. The success of an electrical show does not depend so much upon the expenditure of a large amount of money as upon making it really instructive and widely advertised. Central stations have been known to run a display a week, interest the entire community, get a large amount of new business, and not spend over two hundred dollars.

NEWS ITEMS.

Another opportunity that must not be overlooked is found in news items. There is much about the central station's business and electrical devices that is good news as well as good advertising. A central-station advertiser can keep his company and its activities in the newspaper columns a good share of the time if he goes about it in the right way. The secret lies in picking out the interesting things.

Social events should also be used as a source of inspiration by the central-station advertiser. In smaller towns, where "the sick list" finds place in the news column, it might pay the central station to "loan" a warming pad or some other appropriate device to those customers reported as being ill.

Births might call forth the loan of a milk warmer. By following this sort of policy, the central station will create good feeling, sell current, and gradually initiate its customers to the "life electrical."

There are one or two of these that have not been peculiarly successful. First of all, there is the well-intentioned policy of selling utensils at cost or less than cost with the idea of making up in current consumption. This plan never seems to work out very well. People either distrust the article or come to the conclusion that there is a mint of money for the company in the current the article will consume. Selling articles too cheaply will also antagonize dealers and customers whose aid and co-operation can be made an asset of the central station.

Quite as serious as the first mistake is the tendency to regard the sale of the articles as the end of the transaction. Remember no one is quite as familiar with electrical devices as the central station. People not knowing how to use an article will almost invariably abuse it, and then, when it fails to give good service, who is to blame but the company?

So it is as vitally important to the central station that the consumer knows how to use an article properly and economically as it is to the consumer. For this reason great care should be taken, in every case, that the buyer understands thoroughly how to use and care for the device.

THE FIELD OF ELECTRICAL UTENSILS SHOULD BE ONE OF INCREASING RICHNESS.

Not only are modern ideals demanding a cleaner, more sanitary mode of domestic life, but they also demand that the wife and mother devote more attention to other than mere housekeeping duties. Both of these ends are served by electrical devices.

Nor is this all. Electrical appliances must, of course, make their appeal to people already using electricity as a means of illumination. This should presuppose (unless there is something wrong with the company's policy and the activities of its representatives) a friendly feeling toward the central station with little of the distrust that characterizes people not yet familiar with a concern.

This point, however, is of secondary importance when compared with the fact that these same people already know the value of electricity. This in itself does much to simplify the problem of successfully advertising electrical utensils.

When the chimneyless age arrives, every home will be wired for electricity just as practically every home is now piped for water. The wiring will be much more elaborate than at present.

There will be an electrical heating service and electrical cooking service and an electrical domestic convenience service that will comprehend every human need. Outlets and plugs will be multiplied to the "nth" power. Electrical devices and utensils will be omnipresent. Living room, kitchen, bed chamber, toilet, and den will be so equipped that the genie of the wire may ever be at the summons of its human master.

A race of men will be developed fully capable in mind and body of realizing their complete potentalities.

And not the least important element in this scheme of things will be the central stations of the "Chimneyless Age"—the source of nine-tenths of the well-being and comforts of the entire community.

There will be perfect understanding and mutual good-will between the people who pay the bills and the man who receipts them. Current will cost less to all parties concerned. The central station man's profits will be larger in volume than ever before.

Electricity and electrical devices have merit enough to justify the prediction that, at some time in the course of human events, they will play an all-important part in the daily round of human life—a role even more important and more nearly universal than at present. And the rapidity with which that happy state of affairs is attained depends very largely upon the thoroughness with which the central station advertiser comprehends his problem and learns and applies the lessons that experience has to teach.

Toronto Electric Light Company.

A complete reorganization of the sales department of the Toronto Electric Light Company, Limited, has been effected, with W. A. Martin, the secretary of the company, retaining the active management and Eugene Creed, late chief power agent, assistant sales and advertising manager. The company will continue its policy of energetically convassing the city for new business, and fostering pleasant relations with present consumers. As a result of this policy its Christmas business was phenomenal, and far beyond expectations.

The Company's sales department employs fifteen men, who work on light and power prospects. An energetic sign and outline campaign is now on, and many beautiful signs are in

course of erection on Yonge, King and Queen streets.

The electric building, the four floors of which are occupied by the company, is conveniently located on Adelaide Street just east of Yonge Street. The demonstration department is on the ground floor, opposite the receiving teller's window, and is presided over by a competent demonstrator. Irons are sent out on trial to all consumers, and though the Canadian winters are long and not overly mild, yet the sale of heating appliances is perhaps greater than in many cities of equal size in the United States. The Company expects to have the banner year of its history in 1910.

A New House Organ.

The value of a house organ for a central station cannot be impressed too strongly upon the minds of central-station publicity managers. Through such a medium people are reached, and in many instances interested, who it is safe to say could not be approached by a solicitor. In addition to this, space is available to describe and illustrate fully, numerous electrical devices and methods of applying electricity which the high rates of newspaper advertising make prohibitive.

A house organ to be successful should not have its mission too prominent, but it should have interspersed with its advertising matter items of a general nature, especially items designed to put its reader in good humor. A reader remembers this feature, and instead of throwing away the next number will more than likely give it his attention. One of the newest arrivals in this connection is "The Booster," an attractive publication being issued by the Mount Carmel Gas and Electric Company of Mount Carmel, Illinois.

That the views of this central-station regarding house organs are along the lines above mentioned may be demonstrated by extracts taken from the editor's announcement:

"We have long had in mind the publication of a little magazine, through the columns of which we might furnish our customers and friends suggestions toward using our service to better advantage to themselves.

"Nearly every day someone finds a new application for electricity, gas or water, a new or especially good cooking recipe, or a labor saving idea about the house work. These will be published for your benefit.

"In addition, we hope to entertain you by interspersing clean jokes, bright and trite sayings and clever little jingles. If we succeed in assisting you or entertaining you our object will have been accomplished.

"We invite your criticisms and your help in making this little booklet just what it is intended to be."

Judging from the interesting articles contained in this number and the tone and appearance of the publication as a whole, congratulations instead of criticisms are in order.

American Production of Tungsten in 1909.

The production in the United States in 1909 of tungsten concentrates reckoned at sixty per cent of tungstic trioxide was 1,958 short tons, valued at $746,130, according to figures compiled by F. L. Hess, of the United States Geological Survey, from returns received from producers. These figures represent the exact production for the first eleven months of the year plus the estimated production in December. Of this amount Boulder County, Colo., produced 1,401 tons, valued at $550,280.

In 1908 the total production was 671 short tons, valued at $229,955, and there was therefore an increase in 1909 of 1,287 tons in output and of $516,175 in value, or about 200 per cent. Although it is difficult to make exact comparisons of production for different years owing to the fact that before 1906 no effort was made to estimate the ores at a common degree of concentration, yet the tonnage of 1909 was the largest yet recorded and the value of the product was exceeded only by that of 1907, which was $890,048.

The average price per unit for the whole amount produced in the United States in 1909 was $6.50. In the early part of 1907 the price was $14, but it dropped to $9, and later to $5, and was still lower for most of 1908.

A New Booklet.

The Denver Gas and Electric Company, Denver, Colo., has sent out in addition to its regular monthly calendar an attractive booklet describing and illustrating many electrical devices for domestic purposes.

This central station has been conducting a new business campaign along the most approved lines, and the expenditure therefor is undoubtedly justified by the increased revenues derived.

New York Electrical Society.

The 290th meeting of the New York Electrical Society was held on the evening of December 29 at the United Engineering Societies Building, and despite the holiday season President Beran had the pleasure of addressing well over 150 members and guests when he opened the proceedings.

The extent to which electricity enters into almost every nook and cranny of our social and industrial life was forcibly brought out by the excellent lecture on "Electricity for Every Social Service," delivered by Frank H. Gale, head of the electrical heating department of the General Electric Company. Slides were shown in great number and the endless variety of the applications to which electricity is put was a revelation to many present.

The discussion proved that the subject was indeed a live one in the minds of the contractors as well as the central station men and the results of considerable activity in placing appliances was brought out by Messrs. Osgood, Becker, Lowenthal and Jones.

In closing, Mr. Gale stated that the sales of electric heating appliances for the past year were double that of any previous year and of electric flat irons equal to the sales of the preceding eighteen months.

Elimination of Dust.

M. A. Richet has evolved a scheme to free the air in a room from floating particles and microbe-laden dust or mineral by letting fall a viscous liquid or even water on a moving fan. The plan is simple. A ventilator run by electricity turns in a large open cylinder. Above this is a reservoir holding about three litres, which can be regulated to let out about one litre per hour. The liquid falls drop by drop on the ventilator blades. It is then, by the rapid turning of the blades thrown out in spray against the cylinder. This spray is condensed in drops containing the microbes and dust. As a liquid the inventor employs glycerine, or soap suds, but the plan works very well with ordinary water. The process can be applied to the chemical purification of air, by using suitable chemical solutions as a liquid. The number of microbes contained in water thus collected in the laboratory of the inventor was 100,000 in three hours. The quantity of organic matter per hour was 0.02 gramme and of mineral matter, 0.005 gramme.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$ 580,794	$ 526,574
Expenses	273,044	259,780
November net	$ 307,750	$ 266,794
Charges, taxes and preferred dividend	140,250	143,667
November surplus	$ 167,500	$ 123,127
Eleven months gross	6,345,177	5,846,541
Expenses	2,982,786	2,897,697
Eleven months net	$3,371,391	$2,948,844
Charges, taxes and preferred dividends	1,529,012	1,427,455
Eleven months surplus	$1,842,379	$1,521,388

ATLANTIC CITY ELECTRIC.

The report of the Atlantic City Electric Company for the month of November and twelve months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$ 24,165	$ 19,677
Net	12,680	7,563
November surplus	7,367	2,231
Twelve months gross	316,671	291,433
Net	170,700	151,154
Twelve months gross	$ 105,924	$ 92,482

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway Company, for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$ 90,705	$ 84,476
Expenses and taxes	48,984	47,439
Interest	35,392	34,242
November net	$ 41,721	$ 33,036
November surplus	$ 6,328	*$ 1,205
Eleven months gross	1,020,021	955,364
Expenses and taxes	538,429	534,355
Eleven months net	$481,592	$421,008
Interest	379,939	356,251
Eleven months surplus	$101,653	$ 64,757

*Deficit.

LONDON UNDERGROUND.

The Associated Companies of the London Underground Electric Railways Company report for the month of November compared as follows:

	1909	1908
Metropolitan District Railway:		
Gross receipts	£ 55,530	£ 48,962
Working expenses	28,009	27,036
Net receipts	£ 27,521	£ 21,926
Baker Street & Waterloo Railway:		
Gross receipts	£ 15,815	£ 13,675
Working expenses	7,674	7,605
Net receipts	£ 8,141	£ 6,070
Great Northern, Piccadilly & Brompton Ry.:		
Gross receipts	£ 27,838	£ 24,126
Working exepness	14,409	14,772
Net receipts	£ 13,429	£ 9,354
Charing Cross, Euston & Hampstead Ry.:		
Gross receipts	£ 17,363	£ 15,658
Working expenses	10,541	9,566
Net receipts	£ 6,822	£ 6,092
London United Tramways, Limited:		
Gross receipts	£ 22,311	£ 23,129
Working expenses	17,902	16,433
Net receipts	£ 4,409	£ 6,696
Total all companies:		
Gross receipts	£138,857	£125,550
Working expenses	78,535	75,412
Net receipts	£ 60,322	£ 50,138

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of November and five months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$122,788	$109,912
Expenses	69,525	64,969
November net	$ 53,263	$ 44,942
Charges and taxes	29,586	27,723
November surplus	$ 23,677	$ 17,219
Five months gross	$740,804	$671,466
Expenses	372,108	346,198
Five months net	$386,696	$325,268
Charges and taxes	146,662	138,481
Five months surplus	$222,034	$186,787

NEW YORK AND LONG ISLAND TRACTION.

The New York & Long Island Traction Company has issued a report of the New York Public Service Commission covering operations for the year ened June 30, 1909, as follows:

Total operating revenue	$319,740
Total operating expenses	214,073
Net operating revenue	$105,666
Texas accrued	29,006
Operating income	$ 76,660
Other income	574
Total income	$ 77,234
Deductions	49,414
Net corporate income	$ 27,820
Surplus, June 30, 1908	669,079
Total surplus	$ 96,899
Items of prior periods	10,120
Surplus, June 30, 1909	$ 86,780

INTERNATIONAL RAILWAY (BUFFALO).

The report of the International Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$1,129,535	$1,095,945
Total operating expenses	632,467	658,467
Net operating revenue	$497.067	$437,148
Taxes accrued	60,343	60,480
Operating income	$436,723	$376,668
Other income	8,757	6,441
Gros income	$445,481	$383,109
Total deductions rom gross income	222,726	224,056
Net corporate income	$222,754	$159,052

The report of the Crosstown Street Railway for the quarter ending June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenues	$208,445	$159,400
Total operating expenses	134,140	93,896
Net operating revenues	$ 74,304	$ 65,504
Taxes accrued	13,918	12,196
Operating income	$ 60,386	$ 53,307
Total deductions income	37,175	37,175
Net corporate income	$ 23,211	$ 16,132

CANTON ELECTRIC.

The report of the Canton Electric Company for the month of November and twelve months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$ 24,179	$ 20,796
Net	13,596	10,059
November surplus	10,652	7,374
Twelve months gross	230,550	186,467
Net	115,745	85,062
Twelve months surplus	$ 81,503	$ 54,792

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$175,742	$151,934
Expenses and taxes	99,972	87,976
November net	$ 75,770	$ 63,958
Charges	43,399	44,011
November surplus	$ 32,370	$ 19,946
Eleven months gross	1,994,729	1,730,019
Expenses and taxes	1,088,502	1,000,276
Eleven months net	$906,227	$729,743
Charges	480,856	482,533
Eleven months surplus	$425,371	$247,210

Quebec Jacques Cartier Electric Company Stock Sold to Montreal Interests.

Emerson McMillin, Chairman of the board of directors of the American Light and Traction Company, has issued the following statements:

"The American Light and Traction Company has sold to Rudolph Forget, of Montreal, who represents a holding company recently organized, its Quebec Jacques Cartier Electric Company stock. The stock has been paid for, the new board has been installed, and the purchasers are in full possession. The price obtained was, in round numbers, $1,400,000.

Final negotiations between the representatives of the new Canadian holding company and the directors of the American Light and Traction Company were closed recently. The purchaser is the Quebec Light, Heat and Power Company, which now controls all the public utilities in and around Quebec.

When the Quebec Jacques Cartier Electric Company was taken over by the American Light and Traction Company four year ago, the price paid for the property was $330,000. During the years it has been operated by the American Light and Traction Company it has paid an average of sixteen per cent on that investment, and now it is sold at more than four times what it cost, or at a profit of 323 per cent.

Electric Traction in Russia.

The Municipal Board of St. Petersburg, Russia, is planning to extend electric operation of the street railway system in St. Petersburg by rebuilding immediately forty-three miles of horsecar lines at an expenditure of more than $10,000,000. When this work is completed the entire street railway system of the city will be operated electrically.

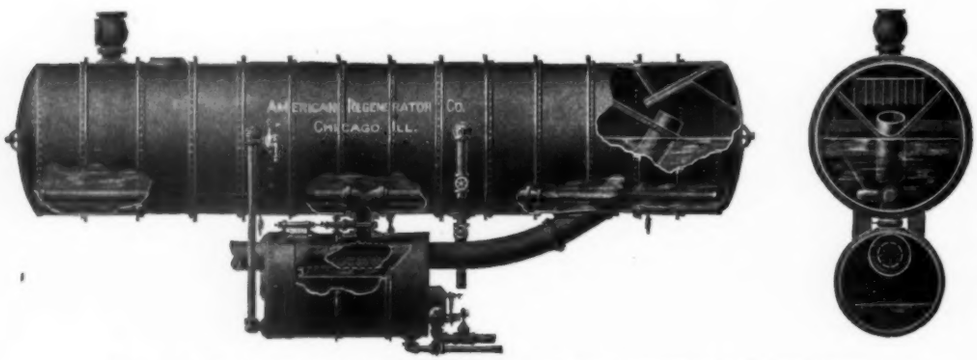
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Power From Exhaust Steam.

It is generally known that the reciprocating engine is more efficient when working through the higher ranges of temperatures and pressure and the steam turbine more efficient when working through the lower ranges. Due to this, several plants have been designed using low pressure steam turbines operating on the exhaust from a reciprocating engine.

However, it has been customary to design these equipments so that the maximum output of the turbine will not exceed the minimum output of the reciprocating engine and whenever there is a surplus of exhaust steam available for a short time it has generally been by-passed to the atmosphere.



SIDE AND END SECTIONAL ELEVATIONS OF THE AMERICAN REGENERATOR.

The American Regenerator Company, Chicago, Ill., is placing on the market an apparatus known as the American Regenerator, which it is claimed presents a means of effectively taking care of differences in load between the two prime movers and of preventing the waste of any steam.

The American regenerator is so designed that each particle of steam entering the apparatus comes into intimate contact with many times its own weight of the coldest water. And because of this the circulation is perfect, and all the contained water is effective.

Referring to the illustration herewith, the water from the larger tank falls through a pipe, containing a valve, into an annular space surrounding the perforated spray pipe through which the exhaust steam from the engine enters at the left. In entering the lower chamber the exhaust steam operates a vane which in turn controls a valve in the pipe connecting the upper and lower chambers, thus the amount of water supplied to the outside of the spray pipe is always proportional to the amount of exhaust steam passing through it.

In this manner the steam comes into thorough contact with every particle of the water, so that the water is heated up to the full temperature of the exhaust steam. The momentum of the steam is sufficient to carry the mixture of water and steam up through the eduction pipe into the upper tank where the mixture is delivered against suitable baffles and separated from the steam.

Thus it will be seen that the coldest water in the regenerator is intimately mixed with the exhaust steam and returned to the surface of the water, inducing perfect circulation and perfect mixture of water and steam. Again, the water level in the regenerator being at the center of the tank gives a shallow depth of water, enabling steam to be readily disengaged during re-evaporation and presenting the maximum surface for the disengagement. It should be borne in mind that the hydraulic head of a body of water influences the speed of evaporation. The increase in temperature required for the liberation of steam is one degree Fahrenheit for each eight inches depth of water. Given sufficient time, the warmer water, would, of course, come to the surface by gravity circulation, and liberate the steam, but in the apparatus of the kind we are here describing time is one of the principal elements.

A further advantage of carrying the level at the center line of the tank is that it gives a greater liberating area which means less tendency toward priming and carrying over of water with the steam to the turbine. It is of the greatest importance that the steam supplied to the low pressure turbine be as dry as possible, not only for the purpose of economy but also to prevent erosion of the turbine blades.

The use of a regenerator serves to smooth out the variations between the momentary discharges of the reciprocating engine and the demands of the steam turbine. The regenerator is to the steam turbine-reciprocating engine combination what the storage battery is to the electrical circuit, or the fly-wheel is to the reciprocating engine. Tests on installations with and without regenerators show that the saving which a regenerator will effect pays a good return on the investment.

Continued Demand for Steam Engines.

Some people have feared that the development of the steam turbine would soon make the manufacture of reciprocating steam engines almost a thing of the past. But, in fact, this is not true. There are today many steam engines being sold, and these engines are almost uniformly of better design than those formerly on the market. An indication of the present demand for reciprocating steam engines may be gained from the fact that one manufacturer alone, the Allis-Chalmers Company, averages shipments from its works of two engines every three days. These vary in size from the 12 by 24-inch single type to compound and triple expansion engines of large size.

A Westinghouse Review of 1909—General Advance in Many Lines.

Although the year 1909 set no advance in transmission voltages beyond that of the first 110,000-volt line of the Grand Rapids-Muskegon Power Company (July, 1908), two other large generating and transmission systems, comprising Westinghouse apparatus and operating at this extreme potential, have since gone into service with records of successful performance. These are the Southern Power Company, Charlotte, N. C., and the Hydo-electric Commission of Ontario, Toronto, Canada. The year's progress in high-tension transmission has been rather in the more complete and accurate control of the present standard working voltages, resulting in the development of adequate switching and protective apparatus for the high-tension currents encountered.

The twlevemonth just closed has seen the development and practical operation of the first circuit breaker or switching apparatus for controlling 110,000-volt circuits. A number of these Westinghouse type "GA" oil breakers have been installed on the lines of the Southern Power Company and are giving excellent service. The switch elements of these breakers are immersed in oil, in separate, lined tanks, and are connected only by pull-rods. The breakers tend automatically to open by gravity, and are released by a tripping mechanism energized from series relays or series transformers. They are both electrically and hand operated.

A new "built-in" type of series transformer designed for this line of breakers (which are furnished for voltages from 44,000 to 110,000 volts) is rigidly constructed around the terminal as part of the case, making the series transformer trip connections compact and self-contained.

Electrolytic lightning arresters of improved design are now offered for the protection of lines up to 110,000 volts. These represent recent advances of the pioneer research work which developed the first aluminum-cell arrester in 1907, while mechanically the present types include great advantages in the superior ease of installing and filling, and in discharging the cells to reform the film, over any arrester yet devised. Special electrolytes, ready mixed, are provided for various conditions of temperature and have given satisfaction.

The largest self-cooling transformers ever built were recently completed at East Pittsburg. Twelve of these 1,000-kilovolt-ampere units of the 100,000-volt type have been furnished the Southern Power Company. The large radiation area necessary to dissipate the heat from a transformer of this capacity is supplied by surrounding the case with a series of tubes, opening into the interior at the top and bottom of the oil chamber. The strong and simple construction of these units, and the small attendance and space they require, supplies the demand for large self-cooling apparatus in places where water-cooled units are troublesome and attention is limited.

Nearing completion at this time are the first single-phase freight locomotives for the New Haven service. One is of the geared type, the other has side-rod connection between motors and driving wheels. The motors of each are located in the cabs, raising the center of gravity of the locomotive as a whole. These machines are designed for both 11,000-volt alternating and 600-volt direct-current operation, and have multiple-unit control. The geared locomotive equipment comprises four 350-horsepower, single-phase, compensated series motors.

For the tunnel and terminal service of the Pennsylvania Railroad Company at New York city, twenty-four side-rod, 600-volt direct-current locomotives were ordered, several of which have been completed. These machines will haul heavy through passenger trains over the severe grades of the Hudson and East River tunnels, and are the most powerful electric locomotives ever built. Each consists of two half units, carrying 2,000-horsepower interpole motors connected through side rods to the pairs of sixty-eight-inch drivers. These locomotives are capable of starting a 500-ton trailing load up a two per cent grade, or hauling it at a speed of sixty-five miles per hour on the level. Both half units may be operated from either cab.

The superior qualities of electric drive for steel-mill service have resulted in continued orders for large and small motors for this work. The Westinghouse Company recently completed a number of 3,200-horsepower type HF three-phase induction motors for the merchant mills of the Indiana Steel Company at Gary, Ind.

The great demand for motors for mill service has led to the design of the new, squirrel-cage, type MS Westinghouse motor, built with the special view to meeting the severe and racking conditions of mill service. This machine is very sturdily built in all parts, and is easily dismantled when repairs are necessary. The secondary bars are bolted to the end rings without solder. The bearings are built with large wearing surfaces.

Of some interest, perhaps, is the marketing of the "general utility" small motor for household and shop use. As its name implies, this ingenious little machine can be adapted to a variety of purposes, including service as a sewing-machine motor, small power motor, polishing, buffing and grinding motor, blower, jeweler's lathe, etc., etc.

In the illuminating field, the metallic flame lamp has been given important refinements during the year, and in conjunction with the constant-current rectifying outfit, makes it, in the opinion of many competent engineers, the most satisfactory street-lighting system that is now offered.

The tungsten lamp has affected the series incandescent situation even more radically than it has constant-pressure lighting. Efficient and accurate regulators have simplified series operation, while the adjuster socket system enables a series circuit of lamps to be imposed directly across constant-current mains, without other apparatus, but with all the electrical advantages of both forms of circuit connection.

In the household, the greatest advance in the use of electric current is destined to be in electric heating. In the ten years that electric cooking has been a fact, no heating element has been introduced that created so favorable an impression because of its simplicity, compactness, efficiency, cleanliness and convenience as the new immersion type of unit brought out by the Westinghouse Company's heating engineers.

The familiar grid element is assembled and insulated on mica sheets, and the whole clamped between two sheets of steel whose edges are then welded in an oxy-acetylene flame. The result is an unbreakable, unburnable, impervious electric heater, absolutely iron-clad. This heater is furnished for use with a number of different cooking utensils and can be fitted to any existing chafing dish or other cookery outfit.

Curing Meat by Electricity.

In furtherance of an article "Meat Curing by Electricity," which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for December 25, 1909, the following description is given of the plant of the Electric Meat Curing Company, of Cleveland, Ohio.

Although this plant actually supplies electrically cured meats to over 400 stores in the city of Cleveland, it is really a demonstration plant, as the principal business of the company is stated to be the licensing of the electric curing process under royalties, and the installation of the process in existing plants.

The curing room, part of which is shown in Fig. 1, measures eighty by forty feet, and is designed for twenty tanks. Its capacity is 7,200,000 pounds of bacon, or 960,000 pounds of ham, a year.

The meat is placed in the tanks in layers, each layer separated by a wooden rack, thus permitting the circulating pickle to pass through the tank and cool the meat. Two men can fill a tank with meat in an hour, and empty it in half an hour, this being all the handling of the meat which is required during the process of curing. The circulation of the pickle is necessary in the electric curing process in order to keep the temperature below the safe curing point. The brine for a number of tanks can be circulated by one centrifugal pump, which latter can be seen in Fig. 1, or each vat can be arranged with an independent cooling tank and circulating equipment as is shown in Fig. 2.

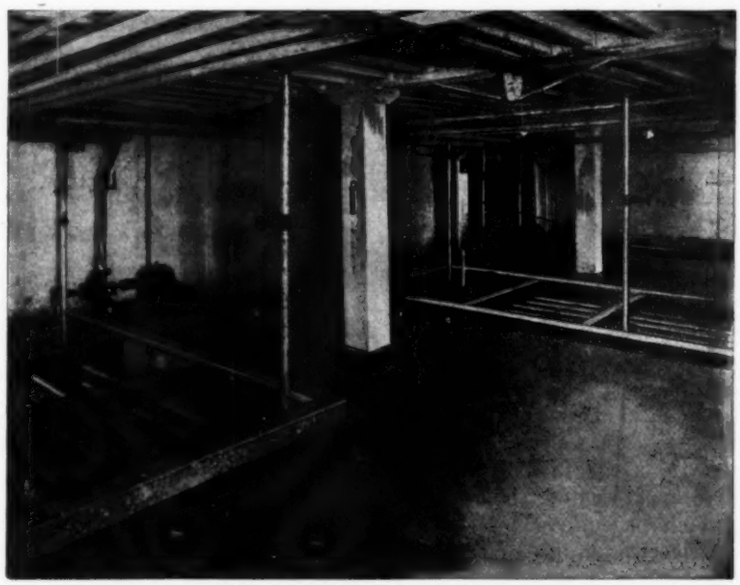


FIG. 1.—PART OF CURING ROOM SHOWING COOLING VATS, WITH COVERS OFF, AND CIRCULATING PUMPS.

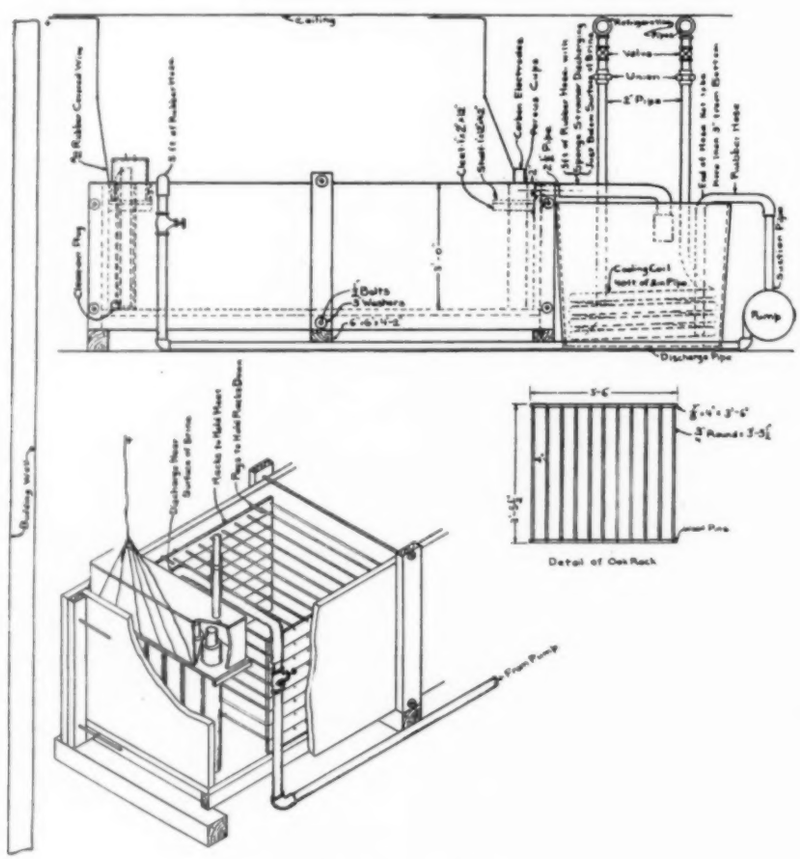


FIG. 2.—DETAIL DRAWING OF VAT.

The number of cures which can be made with the same pickle under the electric process is yet undetermined. Enough data has been gathered to assure to the packer a large saving in pickle cost. The purifying qualities of the electric current obviate the necessity of boiling or sterilizing the pickle after each cure, as is necessary under the old way of curing. Each electric curing vat required three hogsheads of pickle at the start. One hogshead of fresh pickle, for each vat, in use, is added to the old pickle after two cures of 4,000 pounds each. Thus electric current forces into each 8,000 pounds of meat the ingredients of one hogshead. The adding of one hogshead of pickle brings the saturation up to requirements. It is stated that this plant has used the same pickle for twelve cures, and that the solution today is as good as when the plant was started, there having been added new pickle after each cure of 8,000 pounds as above stated. The United States inspector, located at the plant, has forwarded to Washington a sample of pickle after each cure. The electric current serves as a germicide in keep-

ing the pickle pure and fresh, and it is necessary only to keep adding to the old liquor the salt that has been absorbed by the meat in curing.

Each vat or battery of vats used for curing meats requiring different pickle solutions has a separate cooling and circulating system. In this plant there are three systems, one for bacon, one for ham, and one for beef. Hogsheads and barrels are not necessary in the electric system of meat curing, thus eliminating the heavy cost item of cooperage.

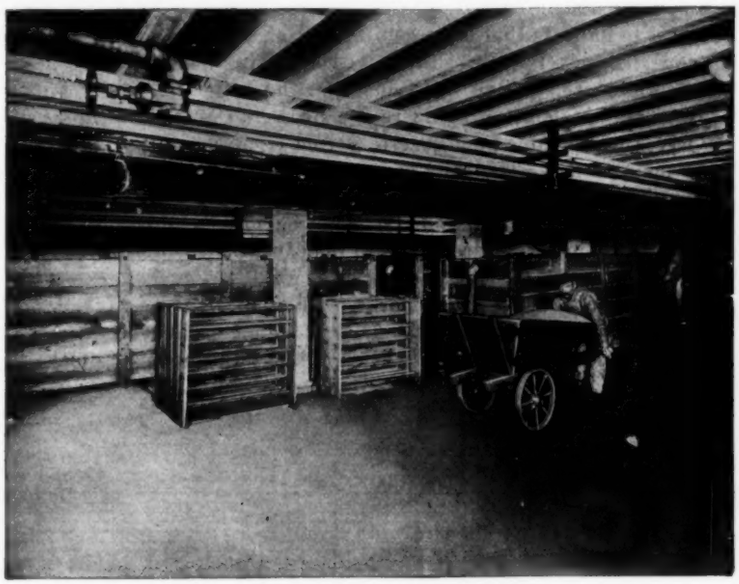


FIG. 3.—ONE OF THE PACKING ROOMS.

The electrical equipment consists of one transformer for twenty vats or less, one voltmeter and one ammeter for the entire system, and for each vat ten carbon electrodes, five at each end of vat, one switch and a regulating rheostat. The switchboard upon which the volt and ammeter, switch and rheostat are mounted is located in the engine room, and is under the control of the engineer. The wiring is so arranged as to enable the engineer, by throwing a switch, to take his hourly readings of the volts and amperes being consumed by each separate vat. The cost of the current per vat is fifty cents for twenty-four hours for an average case of central-station service.

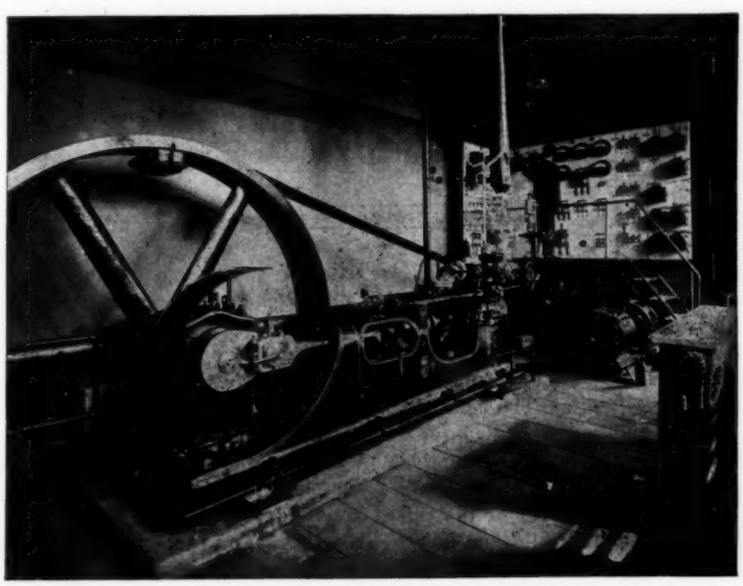


FIG. 4.—PARTIAL VIEW OF ENGINE ROOM.

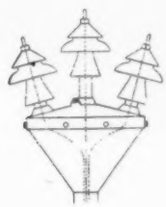
In the wash room and lower smoke houses, electric branders are used exclusively, and have proved very satisfactory.

One corner of the engine room appears in Fig. 4, which shows the Niebling compressor, switchboard, and an engineer in the operation of taking his hourly readings of the instruments. The wiring is so arranged that all the electrical control is in the hands of the engineer, and this official can ascertain from his instruments the electric conditions in the curing vats and rooms without his leaving the engine room.

Waterproof High-Tension Pothead.

A new type of outdoor pothead for use in connecting between high-tension overhead lines and lead cables is illustrated herewith and has been placed on the market by the Central Electric Company, Chicago, Ill.

This pot head is of weatherproof construction and designed to be mounted on a cross-arm, or pole. It will be found particularly useful where it is necessary to connect high-tension transformers to underground distributions.



TYPE E POTHEAD.

The porcelain insulators are of special design having a continuous passage in which is located a hollow steel pin lined with treated wood. Means are provided for effectually sealing the insulator cones against entrance of moisture.

The supporting case is of iron or aluminum as desired and provided with a metal chamber arranged to be filled with insulating compound. As will be seen from the illustration the lead-covered cable enters from the bottom of the chamber and the three high-tension lines leave at the sealing cones of the insulators.

Street Railway Operating Costs in Detroit.

A report of the citizens' committee of fifty in Detroit, Mich., which has been investigating the local traction question for the past year, states that the actual cost of street-railway service in Detroit works out to 3.75 cents per passenger.

Graphic Meter in Substation Rendered Possible Reduction in Generating Equipment.

An example of the value of the graphic recording meter for analyzing power loads was recently shown in a substation which supplies power to the terminal yards of a large railroad system. In this instance, as a result of the application of the meter, it was found possible to reduce the capacity of the machines operating by more than half, thereby diminishing operating expenses and improving the efficiency and load factor of the remaining generating equipment.

The substation referred to contains one thirty-seven and one-half-kilowatt and two twenty-five-kilowatt motor generator sets. These supply direct current at 250-volts to three turntables and one small crane. Each of the turntables is driven by a twenty-two-horsepower series motor with rheostat controller, and is capable of turning a locomotive 180 degrees, or end for end, in one minute. The crane is about five tons capacity and subject to very intermittent service, so that its operation has little effect on the total station load.

The turntables are held ready for service at all times. Rush hour periods occur in the morning and evening, and at these times the tables are usually very busy. A locomotive to be turned goes to the nearest unoccupied table, and in this way it is rarely the case that two turntables are started at once, although two or three may be in operation at the same time.

Before the study of the actual load conditions had been begun, it was customary to operate all three motor generator sets during the rush hours. At these times the violent oscillation of the needles of indicating meters on the generating panels, striking against the stops seemed to indicate that more generating capacity was needed. In order to determine this latter question definitely, a Westinghouse graphic recording meter was obtained and inserted in the main feeder. The tests covered a week's careful study, during which time the load on the station was continuously recorded. That section of the curve reproduced herewith was secured during one of the rush periods. To obtain a clear record, a paper speed of twenty-four inches per hour was used.

The record shows that the average peak encountered during the starting of a turn table is 120 amperes. This drops to a value of from fifty to seventy amperes during operation, after the table has been accelerated. The maximum peak noted was about 180 amperes at the time of starting two turntables simultaneously.

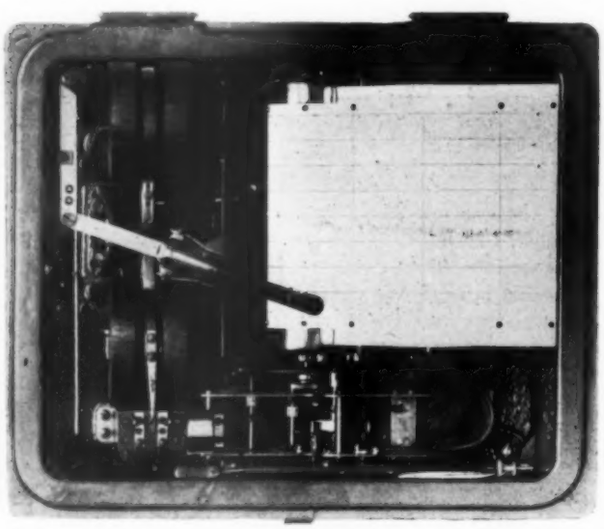
As the full load current of the thirty-seven and one-half-kilowatt motor generator set alone is 150 amperes, it becomes very clear that the existing station capacity is ample to handle the present service besides a large future increase.

Since the tests it has been found necessary to operate only the one largest unit, and the former practice of running all three sets has accordingly been discontinued. The result has been improved operating economy, efficiency and load factor.

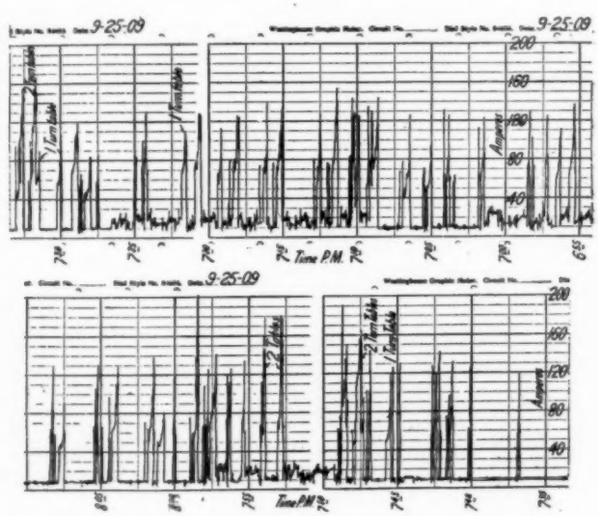
This example thus cites an instance where, in spite of a suspected insufficient station capacity, it was demonstrated that less than half the equipment already installed was needed for the existing demand. The graphic indicating meter is equally impartial in showing up overloaded apparatus, and often performs valuable service in indicating unsuspected load conditions which give rise to excessive heating and impaired regulation and efficiency, the cause of which cannot otherwise be traced.

The important results obtained from graphic meter analysis of motor driven machines and apparatus have been repeatedly shown. Loss of time has been eliminated, and the productiveness of both machine and operator largely increased as a result of the definite location of "low spots" in the motor load curve.

Experience has proven that in almost every power operation there may be considerable unknown and unnecessary losses, which may be promptly localized by analyzing the graphic meter curve, and remedied with resultant increased production or decreased operating expense.



WESTINGHOUSE GRAPHIC RECORDING METER.



GRAPHIC METER RECORD OF TURNTABLE LOADS.

Exports of copper for the month of December were 28,104 tons compared with 21,890 tons the same period last year. For the year 1909 the exports were 301,657 tons compared with 290,243 tons in 1908.

Allis-Chalmers Company's Review of the Electrical Business in 1909.

The following opinion on developments in the electrical field during the past year has been formed from a consideration of the various demands for apparatus that have been made on the Allis-Chalmers Company, of Milwaukee, Wis.

Possibly the largest increase in demand along any one line has been the call for turbo-alternators. The sales of this type of apparatus have increased practically four-fold over those of the year previous. These have varied in size from 300 kilowatts to 5,000 kilowatts, the 500-kilowatt units having the largest sale of any one size. Most of the turbines have been intended to run condensing but there have been many calls for non-condensing turbines. The year has also seen the satisfactory commercial development of the low-pressure and mixed-pressure turbine.

There exists a greatly increased demand for gas-engine-driven generators. The design of gas engines has now reached a stage where accurate results can be predetermined, and this has made possible the building of them for all classes of work. Gas engine generators are now used for railway, lighting, power and practically every kind of electrical load. The engines operate on natural, producer or blast-furnace gas. This type of machine has proven its reliability by operating a straight year on a railroad load with a shutdown of only one and one-half hours due to engine troubles. Undoubtedly the future will see a wonderful development in the widespread use of the gas engine in connection with the generation of electricity.

Another field that has seen greatly increased activity during the past year is that of low-head waterpower development. The greater number of low-head than high-head waterpower sites has brought this class of machinery prominently into view. With our present types of hydraulic machinery, heads as low as seven feet are successfully developed. The size of the low-head units run as high as 4,000 kilowatts. The use of low-head hydraulic machinery has also brought into more general use the vertical-shaft type of alternator. Such machines are, of course, specially designed for this class of work and are performing the service very satisfactorily.

There has been an increasing use of electrical drive in all sorts of manufacturing establishments. Practically every textile mill that is now designed is arranged for the electrical operation of the machines, either singly or in groups. Not one of the larger cement mills built during the past year but has been equipped throughout with electric drive. By the elimination of shafting and belting the total power requirements are reduced nearly one-half. The use of the dustproof motor has also been of assistance in developing this field. Among saw mills, several of those built during the past year have been entirely equipped with motor drive.

Motor-generator sets of large capacity are coming more generally into use as designers are perfecting them and users are discovering their adaptability to various conditions. To some, the complete separation of the alternating-current and direct-current sides seems to be an advantage. In the motor-generator field there has also been a very interesting development in the flywheel generator, as it is called. For the most part the motor and generator have been separate machines mounted on the same shaft with a flywheel, but a notable installation recently made at Toledo, Ohio, had the motor and generator in the one machine. This type of apparatus has proven very effective in giving a steady load to the line and in having the ability to meet wide fluctuations in demand from operating apparatus. In connection with coal-unloading devices the machine mentioned has demonstrated its worth and the soundness of the principle of the design.

The present year has seen a great advance in all lines of electrical work and an increase in demand that exceeds previous records. From the present outlook for the coming year the growth will be much more marked in 1910 than during 1909.

Minneapolis Steel and Machinery Conference.

The Minneapolis Steel and Machinery Company held a conference of its district representatives and department managers on December 14th, 15th and 16th, at Minneapolis, Minn. Daily sessions were held at which papers were read by G. M. Gillette, G. W. Pope, A. M. Burch, A. H. Allen, J. L. Record, R. P. Gillette, Jos. Garbett, E. Brozezinski, E. Leverton, J. R. Ware, Geo. L. Gary, E. F. Woodcock and E. A. Merrill, each paper being followed by a general discussion of the subject presented.

This was the first yearly meeting of the company's staff and was attended by all its salesmen from its various agencies and the company feels that it has resulted in great good in bringing its representatives together with the home office, discussing its business policies and plans for the coming year, and it is the intention hereafter to hold these meetings annually. Included among the entertainments were a theater party and a banquet.

New Benjamin Tungsten Fixtures.

A new tungsten fixture especially adapted for use in factories, shops, warehouses, is being placed upon the market by the Benjamin Electric Manufacturing Company, 507 West Jackson Boulevard, Chicago. The accompanying illustration shows its principal features, among which are a twenty-inch porcelain enameled steel reflector to assist in the downward radiation of the light, eight-inch stem of one-half-inch iron pipe, and tungsten shock absorber. Forty-watt, sixty-watt, or 100-watt lamps may be used. In three and four-light fixtures the sockets are vertical; in five and six-light fixtures, at an angle of fifteen degrees, thus permitting the use of larger units, and increasing the lighting efficiency by making it unnecessary for the light of one lamp to pass through the others.

A NEW BENJAMIN TUNGSTEN FIXTURE.

Electric Storage Battery Stock.

The raising of the dividend of the Electric Storage Battery Company from three to four per cent indicates the rapid recovery of that industry from the late depression in general business. The English branch, and the various manufacturing concerns which Electric Storage Battery controls in the United States are expected to make larger dividend returns to the

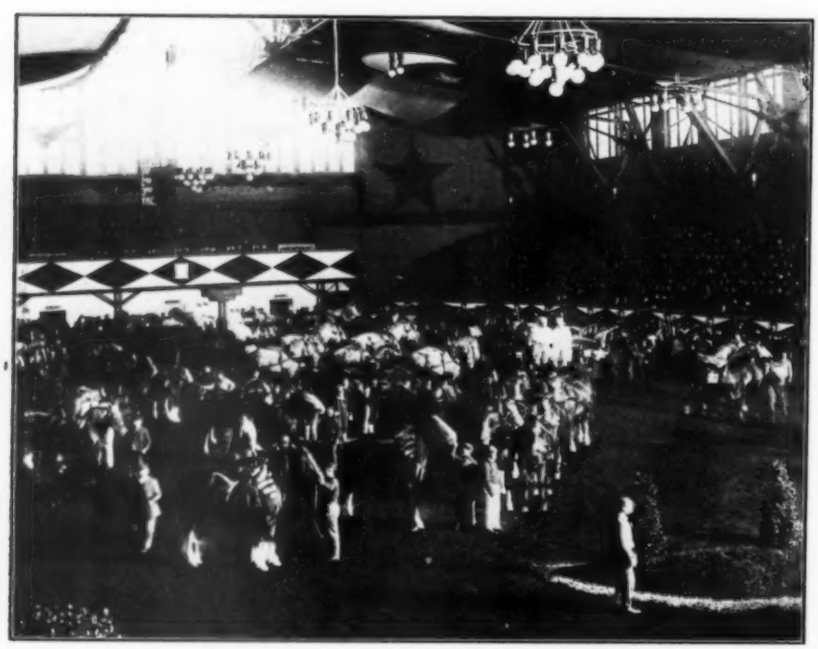
parent company in the near future. A demand from the railroads for storage batteries in connection with their car-lighting system on passenger trains is increasing rapidly, and the company is now negotiating with some of the transcontinental lines for several large contracts in that connection.

The development of waterpower companies throughout the country means the larger use of the product of the Electric Storage Battery Company.

The increasing demand for the use of commercial as well as pleasure vehicles will also add to its revenues.

Lighting of the Chicago Stock Show.

There have been but few indoor exhibitions in which the value of the flaming arc has been so well demonstrated as at the recent International Live Stock Show, held at the Union Stock Yards, in Chicago.



VIEW OF ARENA, LIVE STOCK SHOW, CHICAGO.

The immense size of the building and arena in which the exhibition took place made it necessary to have arcs which could throw a bright, even light over a considerable area. Moreover as horseback riding and jumping formed part of the program it was necessary to have a light free from sharp confusing shadows.

Excello flaming arcs were selected as being admirable suited to the requirements, and when combined with the enclosed arcs which were used, the result was one which closely rivalled the light of day.

It may in fact be said that much of the popularity of the stock show and of the horse show which succeeded it was due to the excellent lighting of the building in which the exhibition took place.

The Latest Type of de Forest Radio Telephone.

During the last eighteen months Dr. Lee de Forest has been developing an entirely new type of radio telephone transmitter, radically different from the arc type. The new "Oscillator," as it is called, is operated from a direct current source of 600 volts, in series with a resistance. The electrodes are both of metal, constantly renewed, never in contact, perfectly cooled. No hydrogen, or hydro-carbon gas or vapor whatsoever is employed.

The wave-length of the oscillation set up remains constant assuring proper position of the receiver during a prolonged conversation.

The electrical and mechanical advantages have been firmly protected by broad claims allowed by the United States Patent Office.

A simple water-circulating system is combined with the apparatus, and this is made further use of to keep the two microphones of the transmitter perfectly cooled.

Dr. de Forest has developed a water-cooled microphone which while allowing as clear and free articulation as the non-cooled type, can still carry two to four-ampere high-frequency currents without appreciable rise in temperature.

The condenser is smaller and lighter than previously. The same form of primary coils together with easily adjustable loose-coupling arrangement, are retained.

Dr. de Forest has done away with the original "chopper" device for calling purposes and telegraphing. In place of this an adjunct is provided having no moving parts and which by throwing of a switch transforms the telephone into a telegraph instrument which gives at the receiving station a high clear musical note (about 1,000 vibrations per second).

The variometers and loose-couplings are designed to give minimum of damping losses with maximum inductances, and convenience of manipulation and simplicity. Each conductor is built up of thirty-five to eighty-four strands of copper wire, separately insulated, and braided together coils are wound on ebonite or seasoned hard wood.

With kilowatt apparatus the range of the new telephone is from fifty to 100 miles, depending on the height of masts and nature of the intervening country.

Grinding of Calcium Carbide for the Manufacture of Cyanamide.

Calcium carbide to be used in the manufacture of cyanamide has to be reduced to a very fine powder. During the pulverizing process explosions frequently take place in consequence of the liberation of acetylene under the influence of the humidity contained in the air. The explosive mixture of acetylene and air is ignited by the small sparks resulting from shocks of the metallic parts in the mills. The Cyanid Gesellschaft has patented a milling system operating in a closed space filled with nitrogen, by which arrangement these explosions are prevented. The patent states that it will be practically impossible to replace the nitrogen by inert gases, because they generally contain carbonic enhydride as an impurity, and this reacts on the carbide.—*Translated and abstracted from L'Industrie Electrique (Paris), November 30.*

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 24.—Ever since the Birmingham Corporation acquired the old company, strenuous efforts have been made to develop power supply. The result has been very gratifying, both as regards the amount of electricity now supplied for power purposes and also the relations between the corporation, the consumers and the manufacturers. The leading electrical manufacturers of Great Britian, all of whom have branches in Birmingham, last week entertained at dinner all the power consumers on the corporation's mains, and also many prospective consumers. This was certainly a tactful move, as the development of electric supply in Birmingham during the past few years has been so rapid as to cause the corporation to contemplate the erection of a new power house larger than the existing one.

It is announced that the Brennan mono-rail patent rights in Germany have been disposed of in so far as an exclusive license has been granted. The recent somewhat hurried demonstration of the Brennan car near London was the result of certain movements of a rival inventor in Germany who was, in a more or less veiled manner, charged with having modeled his system upon that of Brennan. The fact that this particular inventor has acquired the Brennan rights in his native country is evidence of his bonafides. It seems very much that the German car is to be manufactured under Brennan patents, for permission has been granted for the German car to be exhibited in the United States for three months, with an option for a longer period.

In connection with the recent discussion at the Institute of Electrical Engineers upon a comparison between the English and German electrical industries, a difference of opinion has manifested itself as to the position which the Institution takes up towards the industry here. Nominally the Institution's functions are to deal with technical matters, but a good section of the members are of the opinion that commercial matters should be considered in a larger degree than has been the case hitherto. Unfortunately, unless very great tact is exercised this will plunge the Institution into politics, which would be disastrous. Those urging reform have in mind, largely, fiscal matters upon which the members are divided in opinion. There is also the fact that municipalities have entered into the electric supply industry to a very large extent and here again we find municipal and company engineers members of the Institution, but naturally, except on purely technical matters, of opposite opinions. It will thus be seen how difficult is the position of the council of the Institution in considering a change of policy. The matter has been taken up by certain members and is now under consideration by the council. Should no agreement be arrived at, it would not be surprising to hear of an attempt to form a new institution to deal with industrial and commercial matters.

It is now announced that the proposals of the syndicate composed of the National Telephone Company, the British Insulated & Helsby Cable Company, the Western Electric Company, of Chicago, and the French Thomson-Houston Company, to establish a telephone service in Constantinople have been accepted and will be submitted for the formal ratification of the Turkish Council of Ministers.

The Electrical Contractors' Association continues to do good work on behalf of the electrical contractors in England. It has compelled another corporation, who are applying for Parliamentary power to wire consumers' premises, to agree to give the work out to local contractors. All municipal bills for next session are being closely watched and the corporations are notified of the intention of the association to oppose them before the select committee of Parliament, unless it is agreed not to set up a municipal wiring and fittings department.

The enormous amount of work still being done upon the London County Council is shown by a decision to spend $150,000 more upon rails and $110,0000 upon reconstructing further lines in north London.

With characteristic energy, the manager of the Marylebone (London) electricity undertaking, is devising a co-operative scheme for the introduction of ice-making plants in his district as a means for improving his load. Special terms are to be granted for electricity for driving icemaking machinery. A tariff has been proposed of $10 per horsepower per annum, plus two cents per kilowatt-hour for all current used.

So successful have been the results with the single phase railway in South London, that it has been decided to proceed with extensions of the lines. G

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 20.—The French Government is taking measures to adopt electric traction on the lines of the West Railroad, on that part of the system which lies in the suburbs of Paris. Not long since, the West Railroad lines were taken over by the State, as up to that time they had been operated by a private company. This latter had already laid out plans for using electric traction, and these are now to be taken up by the State, although they will be modified considerably. The St. Lazare depot will not undergo any great change in this case, while the former project called for the erection of a new depot and this was to have had an extensive underground part. It is estimated that the present depot will be large enough to answer all the needs, however. According to the new plans, electric traction will be used on a more extensive scale than was at first proposed, and this is to be carried out at an expense of $15,000,000. Most of this amount will be needed for installing the electric system on the existing tracks, as well as in the power stations, and at the same time there will be some new tracks added. It is likely that the work will be commenced in 1910, and it will take several years before the system can be put in working order.

Plans are under way for extensive electric lighting operations at Odessa, and a new company has been formed for this purpose. Belgian capital is largely engaged in the enterprise.

Electric traction is to be used on a new line which has been built in Germany between Mittweida and Limbach.

The electric lighting of the Brussels Exposition is to be carried out by the Kabelwerk Rhydt firm.

In Switzerland the rights have been recently granted for the construction of an electric railroad line from Stalden to Saasgrund, and there will also be installed a cable incline from this latter point to Saas Fee.

There is a project under way for building an electric tramway line from Metz to Ranbas, in Alsace.

Storage-battery locomotives are being used to a considerable extent in the German and Austrian mines, and we note the mine plants of Königsborn, operated by the Westphal company, also the Petroseny mines and those of Zaligo. The Tudor storage batteries are used in all these cases.

A new company has been formed in the town of Malestroit, France, for the electric lighting of the town and suburbs.

A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JANUARY 1.—The dividend of the Ottawa Light, Heat and Power Company has been increased from five to six per cent. An extra dividend of one per cent for 1909 has just been declared.

The Ottawa Electric Railway Company has declared a regular quarterly dividend for three and one-half per cent and a bonus of two per cent. This makes a twelve per cent dividend for the year 1909.

An application for a charter for the proposed Toronto Eastern Electric Railway is now before the Canadian Parliament. It is stated that work upon the new road will begin early in the coming Spring.

A new electric railway, to run northward from Toronto to Barrie, with branches to Orillia and Owen Sound, is being organized by Toronto capitalists. Application will be made for a charter at the next session of the Ontario Legislature.

The Niagara Falls, Welland & Dunnville Electric Railroad Company is applying to the Ontario Legislature for a charter. The route of this new electric road will be from Niagara Falls to Allanburg, along the east side of the canal to Port Robinson, Welland and Air Line Junction; west by the Forks-Road to Dunnville. The total length of the road will be about fifty miles. The company is capitalized at half a million dollars.

E. A. Wallberg, of the Mines Power Company, which is developing power at the Matabinchonawa River for transmission to Cobalt, reports that the company, at the present rate of progress, expects to be in Cobalt shortly after the New Year. There is a 310-foot fall at the point named, and the company proposes to supply electrical power and compressed air to the various Cobalt companies.

Mergers in connection with some of the large companies have turned attention to the electrical supply interests, and it is now asserted that the leading electrical machinery construction companies are making overtures for an amalgamation. The three large Canadian electrical supply concerns are the Westinghouse Com-

pany, of Hamilton, Ont.; the Allis-Chalmers Company, of Montreal, Que., and the Canadian General Electrical Company, of Toronto, Ont. Recent keen competition among these companies, in which tenders were given, is thought to have lost money to the concern which has obtained the contract, and has evolved the idea that the combination of electrical supply interests would be beneficial to these companies. It is rumored that an effort is already under way to combine the large electrical interests into one whole, and thus avoid future cutting of prices. Besides, the British preference works harm to the electrical manufacturing interests, so much harm, in fact, that drastic measures are called for on the part of the financial institutions behind many of the electrical companies. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

LARGE POWER PLANT FOR ILLINOIS CENTRAL.—The largest power plant on the Illinois Central Railway system is now in the course of construction at Venice, Ill. The site is under the Illinois approach to the new traction system bridge. Although only half of this plant will be finished at present, this part is to have a capacity of about 14,000 horsepower. Among other generating units there will be one 3,000 and one 5,000 kilowatt Curtis-turbine-generating unit.

NEW VIRGINIA HYDROELECTRIC PLANT.—The Roanoke Electric Light and Power Company has secured a large tract of land and water rights along Staunton River in the vicinity of the town of Brookneal, situated a score of miles from Lynchburg, and proposes to carry out plans for a large hydroelectric development at this point immediately. The waterpower site promises to yield at least 5,000 horsepower, and this power will be transmitted to Lynchburg and other points for lighting and commercial power purposes. Judge E. D. Newman, of Woodstock, Va., is head of the new electric power concern, and L. T. Stoneberger is secretary and treasurer of the company, he being connected with the Shenandoah Trust Company, of which Judge Newman is president. The Roanoke Electric Light and Power Company has an authorized capital of $1,000,000, the charter fee paid to the secretary of state being $750. The development will likely yield much more than 5,000 horsepower, as this amount is promised to the city of Lynchburg alone. L.

LARGEST POWER TRANSMISSION SYSTEM.—The Southern Power Company will have in a short time what is said to be the largest transmission system in the world. The company's transmission lines at present stretch over a distance of 800 miles, and are constantly being added to. On completion of several power houses under way the total power generated will be 200,000 horsepower. Fifty sub-stations scattered through North and South Carolina are now in operation. From the Great Falls plant, which is the largest, three trunk lines emanate. The line to Greensboro on the north and Greenville on the south cover a railroad distance of 202 miles.

LIGHTING AND POWER.

(Special Correspondence.)

KLAMATH FALLS, ORE.—Two plants are to be built on the Klamath River.

HETTINGER, N. D.—An electric-light plant will be put in by C. A. Meyer, of Clarkfield, Minn. C.

HASKELL, TEX.—The Haskell Power Company has been incorporated with a capital stock of $30,000. P.

ARLINGTON, S. D.—The city is figuring on the installation of an electric-light plant to cost about $3,000. P.

CHILLICOTHE, MO.—This city will vote on the issuance of electric-light bonds to the amount of $50,000. P.

DUNCAN, OKLA.—The Duncan Light and Ice Company has been incorporated with a capital stock of $30,000. P.

MT. PLEASANT, TEX.—This city has granted a franchise to M. Greenspun to establish an electric-light plant. P.

MANDEVILLE, LA.—The Mandeville Electric Light and Ice Company will soon begin the erection of its plant. P.

AUGUSTA, KAS.—The city council has granted a twenty-year electric-light franchise to S. J. Stafford and others. P.

TERRELL, TEX.—This city is to vote on bonds for $100,000 for additional machinery in the electric-light plant. P.

CHADRON, NEB.—The Chadron Electric Company has been incorporated in Chadron, Neb., with a capital of $25,000. P.

OKLAHOMA CITY, OKLA.—The Union Gas and Electric Company has been incorporated with a capital stock of $50,000. P.

CALVERT, TEX.—The Calvert Water, Ice and Electric Light Company has recently increased its capital stock from $50,000 to $100,000. P.

FLORENCE, ARIZ.—Arrangements are being made for the electric lighting of this city from the power plant of the territorial penitentiary here. A.

MARENGO, IA.—The Marengo Light and Power Company has been granted a franchise for supplying electricity to the city. The vote was practically unanimous.

LAUREL, DEL.—The Sussex Light and Power Company has been incorporated with a capital of $50,000, by W. M. Cooper, J. D. Price and M. Cooper, all of Salisbury, Md.

SILER CITY, N. C.—O. D. Barber, of Goldston, has plans to build a power plant on Bear Creek, which is expected to develop 200 horse power. The main object is to furnish power for his flour mill.

INDEPENDENCE, CAL.—J. B. Fleming has completed the plant for the Globe Light and Power Company at Daunt, Tulare County, and is now building a hydroelectric plant in the Sequoia National Park for the Mt. Whitney Power Company.

SCRANTON, PA.—The new $500,000 plant of the Scranton Railway company has just been placed in operation, and it is expected that the power troubles are at an end. The engine room contains one 1,600-kilowatt General Electric generator.

DECATUR, ILL.—The Progressive Light and Power Company of this city has recently been granted a franchise to do a general electrical and heating bsuiness. The company is incorporated by Robert T. Hunt, Fred W. Ives and William Hoffman.

AUGUSTA, ME.—The Central Mexico Light and Power Company was organized at Augusta for the purpose of manufacture, sale and distribution of gas, electricity and steam, with $2,750,000 capital stock. E. M. Leavitt is president and treasurer of the company.

SHEBOYGAN, WIS.—The J. M. Kohler Construction Company is installing one of the most modern power plants in this section. Among the electrical equipment will be one 750-kilowatt and one 250-kilowatt generator, both direct connected, and one 150-kilowatt generator which will be belt driven.

MONROE, WIS.—At a recent meeting of the stockholders of the Monroe Electric Company, which is a reorganization of the Monroe Electric Light and Power Company, the following officers were elected: President, A. A. Boyd; vice-president, W. P. Bragg; secretary, H. A. Smith; treasurer, R. F. Garretson.

HARRISBURG, PA.—The Pennsylvania Railroad has planned to install an electric plant in the Columbia yards for the purpose of operating the machinery in the shops and manufacturing current for lighting the station, offices, roundhouse, transfer and the yards. The plant will cost in the neighborhood of $8,000.

OKLAHOMA CITY, OKLA.—The Utility Gas and Electric Company, which is to furnish electric power for the El Reno-Oklahoma City interurban, now in course of construction, was chartered with $1,000,000 capital. The directors are: T. H. Stephens, W. H. Criley, C. C. McVay, F. W. VanNess and Lydia McBride, all of El Reno.

TOWER CITY, PA.—The Tower City Electric Company has been incorporated with a capital of $5,000. The purpose is to supply light, heat and power to Tower City and the company's business will be transacted at Harrisburg. The present stockholders are: Geo. M. Whitney, J. W. Milhouse and Wm. S. Snyder, all of Harrisburg.

CLEVELAND, OHIO.—A franchise for extension of lines that has been pending for some time has been granted to the Cuyahoga Light Company. J. C. Keys, president of the company, said that $1,000,000 will be immediately expended by his company to make improvements. Ultimately the company is expected to install a $6,000,000 plant in Cleveland.

BRIDGEPORT, ALA.—The announcement has been recently made that this city will have a first-class electric-light plant. It is definitely settled that a plant will be installed in the near future and W. G. Scarbrough and associates have formed a stock company to install and operate it. Actual work on installation of the machinery will soon begin and the plant is expected to be in operation by February 1, 1910.

WORCESTER, MASS.—A new system is being established by the Westboro Gas and Electric Company, whereby the town will receive its electricity for lighting and commercial purposes from the Connecticut River and Power Company. The Westboro system will intersect the Marlboro Electric Company line at Northboro. A new addition has been completed to the present plant of the Westboro Gas and Electric Company on Grove street. The new system will be in operation in a short time.

BRATTLEBORO, VT.—The reconstruction work at the distributing plant of the Twin State Gas and Electric Company in order to fit it to take power from the Connecticut river dam is completed and the work on the various circuits about town is practically done. At the present time all the lights are being run on power furnished by the West River power plant and the street railway is being operated by power from the Connecticut river. In the event of any failure in the West Dummerston plant, the power from the Connecticut river dam can be turned on instantly. It is possible still to use the steam plant if both the water powers should fail at the same time.

SAN FRANCISCO, CAL.—The Hawkins Electric Company has ben incorporated here with a capital stock of $20,000 by C. W. Klipsch, D. L. Anthony and O. T. Barber. A.

TOLEDO, O.—The city of St. Mary's, O., will pay $22 per lamp more for the street lights in 1910 than it did in 1909. A jump from $35 to $57 per light is announced by the retiring board of public service. H.

PHOENIX, ARIZ.—The city council has instructed the city attorney to take steps toward obtaining permission from Congress for the city to bond itself for $300,000 for constructing a municipal lighting plant. A.

PENDLETON, IND.—The Pendleton Electric Light and Power Company, recently organized, has ordered plans for the erection of an electric light and power plant. Ira M. Holmes, of Indianapolis, is president. S.

SHERWOOD, O.—This village will install an electric lighting plant early in the Spring. Bonds to the amount of $4,000, for this purpose, were recently sold to the First National Bank of Bryan, at a premium of $81. H.

SEATTLE, WASH.—The New Westminister-Mission Light and Power Company has been incorporated with a capital stock of $50,000, for the supply of light to the town of Mission City, thirty miles up the Fraser River. A.

PRINCE RUPERT, WASH.—The Grand Trunk Pacific Railway Company is fitting up a temporary electric-lighting plant to light its terminals and office buildings until the old plant at Seal Harbor, recently burned, can be rebuilt. A.

ROSWELL, N. M.—Joseph M. Swaziek, of El Paso, Tex., who has been in this place for several days, states that he will put in an electric power and pumping plant on the Penasco River. Power rights have already been secured. A.

EUGENE, ORE.—A plan has been outlined by Manager J. H. Hartog, of the Commercial Club, for the augmentation of the street lighting system of this city. Mr. Hartog has secured a contract with the Northwestern Corporation. A.

TEHACHAPI, CAL.—S. A. Barrett, of Los Angeles, is planning to establish an electric lighting system at Tehachapi. It is proposed to secure power from the Kern River Power Company. If this plan fails a power plant will be built.

SANTA BARBARA, CAL.—Chairman J. N. Miller of the Water Works Board estimates that the municipality can put in a hydroelectric power and lighting plant and distributing system in connection with its water plant at a cost of $100,000. A.

EVANS CITY, PA.—The Evans City Light, Heat and Power Company has been granted a charter and will commence work on its plant and transmission lines at once. The stock of the company is held by R. A. Todd, A. C. Frey and S. A. Roelofs.

TOLEDO, O.—The W. G. Nagel Electric Company, of Toledo, has announced its expansion and will in future carry a complete automobile accessory line. Its sales rooms have been remodeled and a competent man has been placed in charge. H.

SALT LAKE CITY, UTAH.—A new power plant for furnishing light and power to the Utah Agriculture College at Logan has been authorized by the Board of the college. An appropriation of $20,000 was made by the last legislature for this purpose. A.

RIVERSIDE, CAL.—The poles have been strung for the new 30,000-volt power line being built by the Edison Electric Company to this city from San Bernardino. The line comes in on the new Riverside-Rialto road to Main Street. Poles have been strung as far as Santa Ana Street.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power and Manufacturing Company has ordered two 6,500-kilowatt, 12,000-volt, twenty-five-cycle, hydraulically-driven, revolving-field generators. These will be duplicates of the two already installed by the Allis-Chalmers Company.

BROCKTON, MASS.—The recent purchase of the Bridgewater Electric Company's franchise and property by the Edison Electric Illuminating Company has been approved by the state board of gas and electric light commissioners. The board is of the opinion that this merger will bring about better rates and service.

MONTPELIER, VT.—Royalton Power Company has recently filed articles of incorporation. The new company, which will furnish electric power, is capitalized at $16,000. The incorporators are F. L. Walker, Curtis Fletcher and Robert Keltie, of Boston; Marvin H. Hazen. of South Royalton, and A. N. Stoughton, of Royalton.

HAZELTON, PA.—Plans are under way for merging the interests of the lighting company operating at Scranton, and for taking over the smaller subsidiary companies. The object of the new combine is to control every operating company between Scranton and Nanticoke and keep out the Harwood interests.

WAYCROSS, GA.—Bonds amounting to $10,000 have been deposited with the city as surety for constructing a gas and electric-light plant. The company, represented by Burdette Loomis, Jr., of Hartford, Conn., expects to have the plant in operation in a few months. Electric-lighting bills will be reduced thirty-five per cent.

OAKLAND CITY, IND.—The directors of the Oakland City Electric Light and Power Company have decided to add considerable equipment, providing for the installation of a day circuit in the city. The company will also erect and install a new ice plant to be operated in connection with the present electric light and power plant. S.

RED BLUFF, CAL.—The Deer Creek Power Company has filed articles of incorporation with a capital stock of $100,000. The principal place of business is in Chico, Colo., but the power site is in Tehama County. The incorporators are C. C. Royce, W. J. O'Connor, A. G. Eames, T. H. Banard, B. Cusick, Thos. N. Crew and Park Henderson. A.

TOLEDO, O.—The Tiffin Electric Company was this week incorporated with a capital stock of $50,000. Its principal place of business will be at Tiffin, O., where it will supply heat, light and power. It is backed by Toledo capital, of whom the following are named as incorporators: John H. Ormond, R. W. Barton, Lewis H. Paine, F. Schreiner and E. H. Cady. H.

TOLEDO, O.—Bids have been filed by ten firms for the installation of a conduit and electric wiring system and a standard clock system for the new Toledo Post Office Building, which is now well under way. The work must be completed by December 1, 1910. The bids range from $8,350 by Andrew Electric Company, of Milwaukee, to $14,000 by the Wentworth-Dean Electric Company. H.

LOS ANGELES, CAL.—Trust deeds involving $30,000,000 in bonds and executed in favor of Harris Trust and Savings Bank of Chicago and the Los Angeles Trust and Savings Company, of this city, have been filed in the counties of Southern California by the Southern California Edison Electric Company. Part of this money will be spent in the construction of two large power plants on the Kern River. A.

McKEESPORT, PA.—The municipal electric light plant at West Newton has been sold to the West Penn Railways Company for the sum of $14,000; about what the plant cost. The taxpayers are, however, still paying on outstanding bonds amounting to $23,000. The failure of this municipal plant is attributed to frequent changes in the council and to the fact that the members knew nothing of electricity.

MOOREFIELD, W. VA.—J. H. Marsnall and H. O. Barncord, of Midland, Md., were at Moorefield, Hardy County, and completed arrangements for installing an electric-light plant. The Council granted them a franchise for twenty-five years. They also signed an agreement with D. L. Wilson, who will furnish them power. They expect to begin work on the plant as soon as the weather will permit in the spring.

HAMILTON, MONT.—According to a statement made by W. O. Fisk, the Hamilton Light and Water Company will soon begin work on the power plant which is to furnish light and power for the city. The plant will be located on Sleeping Child Creek at a point six miles from this city and will cost in the neighborhood of $150,000. The plant will be designed to generate from 1,500 to 2,000-horsepower. Mr. Fisk stated that the plant would be ready for operation by the first of July.

RICHMOND, VA.—A charter has been issued to the Roanoke Electric Light and Power Company. The incorporators are: Alexandria M. Coffman, Woodstock, president; I. T. Stoneburner, Edinburg, secretary and treasurer; M. Funkhouser, C. C. Skyles, E. C. Geary, all of Woodstock. The company has a capital stock of $1,000,000 and has for an object the development of the waterpower of Roanoke River and its tributaries.

LOGAN, UTAH.—Work will be started at once near Logan for the erection of a power plant to furnish light and power for the buildings of the Utah Agricultural College. The last legislature made an appropriation of $20,000 for the purpose, and this will be used in completing a model plant. The Logan school owns sufficient of the water in Logan River to generate 300 horsepower, which will, it is believed, furnish sufficient power and light for the needs of the state school.

EVANSVILLE, IND.—Plans have been prepared for the new plant to be erected by the Evansville Public Service Company in this city. The plans provide for a plant of the capacity of 4,000 kilowatts—double that of the Evansville electric plant. Provision is made for steam heating for 500,000 feet of radiated surface and for 350,000 square feet of radiation for hot water heating. E. L. Gifford, chief engineer, states that the plant will be the largest of the kind in the state. S.

TOLEDO, O.—The Fremont Power and Light Company filed a suit recently to condemn three acres of land at Fremont, O., owned by Charles J. Greene, to be used as a site for the erection of its mammoth power house. The company has already expended about $100,000 in buying property and its original franchise has been extended to give further time for the completion of its plant. It is constructing an enormous plant and will harness the waters of the Sandusky River. H.

WAYCROSS, GA.—The entire property of the Waycross Electric Light and Power Company has been purchased by Burdette Loomis and his associates, who were recently granted a franchise for the purpose of conducting a gas and electric-light business. The sale was made by John E. Wadley, president of the company, subject to the action of the stockholders. The price agreed on was $75,000. It is the intention of Mr. Loomis to put in an up-to-date plant for furnishing light and power to public and private consumers.

SUPERIOR, WIS.—It is proposed to install ornamental street-lights on Hammond Avenue, from Broadway as far as Twenty-first Street. C.

COLUMBIA FALLS, MONT.—The council is considering the granting of a franchise for the operaiton of an electric-light plant in this city. C.

VALLEY CITY, N. D.—The North Dakota Heat and Power Company, of Fargo, N. D., will apply for a contract to furnish current for the electric-light plant. C.

CANNON FALLS, MINN.—H. M. Byllesby & Company, of Chicago, have purchased the Cannon Falls water power and the Faribault Gas and Electric Company, of Faribault, Minn. They have arranged for a transmission line to Faribault and Northfield, work on which will be commenced the coming Summer. C.

TOLEDO, OHIO—The city council of the city of Defiance, Ohio, is in a peculiar situation regarding electric lights. The Defiance Gas and Electric Company is the only concern in the field, and when the city advertised for bidders for a new contract to light the city, it refused to bid. The city wants $1.00 gas and eight-cent per kilowatt electricity, and the company states that it cannot enter into a contract at those figures. H.

ELECTRIC RAILWAYS.

(Special Correspondence.)

FORT MADISON, IOWA.—There is an agitation for the construction of an interurban to Nauvoo. C.

BELLINGHAM, WASH.—Stone & Webster have plans for the construction of an interurban railroad to Mount Vernon and Sedro-Woolley. C.

POLSON, MONT.—The Somer, Polson & Missoula Electric Railway Company has been incorporated to construct a line to Somers. C.

DULUTH, MINN.—The Duluth Street Railway Company has amended its articles of incorporation fixing its capitalization at $2,000,000. C.

LITTLE FALLS, MINN.—Local business men are agitating the construction of an electric street railway through Long Prairie to Alexandria, Minn. C.

CONWAY SPRINGS, KAN.—A railway line is projected between this city and Genda Springs, a distance of thirty-three miles. This line would traverse a very profitable farming district.

SHEBOYGAN, WIS.—The Sheboygan Light, Power and Railway Company will issue bonds for $114,000 to increase the power station to 1,500 horsepower, put in double tracks and make other improvements. C.

MANDAN, N. D.—The Hudson Center & New Salem electric line has been organized to parallel, at some distance, the extension of the Northern Pacific north from here. Another prospective line is planned to Manning. C.

BALTIMORE, IND.—The United Railways and Electric Company recently inaugurated the use of several pay-as-you-enter cars. These cars are first being tried on the Pennsylvania Avenue line as that is one of the longest routes of the system.

BLUE EARTH, MINN.—C. O. Anderson, a farmer of East Chain, is organizing a company to be called the Peoples Electric Road Association, to construct an electric road to Pilot Grove, East Chain, Center Chain, Wilbert, Ceylon and Estherville. C.

PITTSBURG, PA.—An independent street car line is planned to enter the East Pittsburg district, under a charter given some time ago to the Highland Grove Street Railway Company. This road will connect with the Walls Borough Street Railway Company's line.

CAIRO, ILL.—It is announced from the offices of the Illinois Traction system that the Cairo Railway and Light system has been taken over by the Western Railway and Light Company, one of the component parts of the McKinley system, and will hereafter come under the jurisdiction of general manager H. E. Chubbuck.

LONG BRANCH, N. J.—Preparations are being made for the connection of Long Branch with Seabright, both by the Monmouth County Electric Company's line and the Atlantic Coast line. President George B. Cade of the Atlantic Coast company is favorable to the extension and steps for extension will be taken at an early date.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern Railway has placed an order with Allis-Chalmers Company for extensive switchboard equipment in addition to orders for machinery previously placed. The main switchboard will be located at Galloway and will have twenty-six panels. The three substations will each be furnished with a three-panel board.

REDWOOD, CAL.—A survey has been made for an electric line across the mountain to La Honda and the Big Basin. The proposed road will run from a point of deep water through Redwood City directly to Woodside, from which place it will take one of two routes over the mountain. It is estimated that the road will cost approximately $1,000,000.

SPRINGFIELD, ILL.—The City Belt Railway Company of Rock Island has been recently granted a license to incorporate. The road is to run from First Avenue south to the limits of the city. The capital stock is $50,000 and the incorporators and first board of directors are: Fred S. Denkmann, Otto Huber, Thomas J. Medill, B. D. Connelly and Hugh E. Curtis.

ALTOONA, PA.—According to a report coming from the office of Manager S. S. Crane, of the American Street Railways Company, work is to start in a few weeks on the trolley line between Altoona and Johnstown. The company is also planning a line from Mineral Point to Ebensburg and when both lines are completed a direct route from here to Ebensburg will be open.

LAWTON, OKLA.—The Lawton and Fort Sill Electric Railway Company has decided to issue bonds to the amount of $150,000 in order to meet the expenditure of funds both in the construction of the proposed electric line through the streets of Lawton and connecting Lawton with Fort Sill and Medicine Park. The bond issue will be made shortly, and the financing of the road is assured.

TOLEDO, OHIO.—The control of the Toledo, Ann Arbor & Detroit Electric railway property has passed from the hands of Ex-Governor Arthur E. Lee and his associates to a syndicate of Chicago capitalists. The road today represents an investment of slightly more than $400,000, and James A. Wallace, representing the syndicate, stated that it is intended to issue $200,000 cumulative preferred stock.

CHAMBERSBURG, PA.—At a meeting of the stockholders of the Chambersburg, Greencastle & Waynesboro Railway Company it was decided to increase the indebtedness of the company from $600,000 to $1,000,000. The $400,000 bonds will be used to make extensions from Chambersburg to Red Bridge, to build a line from Pen Mar to Blue Ridge Summit, and to improve the power house at Waynesboro.

ALBANY, N. Y.—The Public Service Commission has granted a certificate to construct to the Hornell and Bath Interurban Railway Company. The company proposes to build a street surface railroad to be operated by electricity between the city of Hornell and the village of Bath, Steuben county, passing through the towns of Howard, Fremont and Avoca, a distance of twenty-four miles. The company has a capital of $250,000.

McKEESPORT, PA.—The McKeesport Belt Line Street Railways Company, composed of McKeesport citizens, has secured a charter and McKeesport councils will be asked to give street franchises. Samuel D. O. Foster, county road engineer, is chairman of the company, and David A. Foster, A. D. Foster and W. F. Hartman are directors. The company expects to traverse many streets not now occupied by tracks in that city.

HOQUIAM, WASH.—Work has been started on the line of the Grays Harbor Interurban Company which is to operate as an electric road between Hoquaim and Tacoma, via Olympia. The company is capitalized at $500,000 and is divided into 100 shares. Trustees have been elected as follows: A. L. Paine and R. F. Lytle, Hoquiam; P. S. Locke and Samuel Benn, Aberdeen; Neil Cooney, Cosmopolitan, and Eldridge Wheeler and W. H. Abel, Montesano.

OLYMPIA, WASH.—Articles of incorporation have been filed for the Grays Harbor Interurban Company, a company which will operate trolley cars along the roads of Chehalis county and through to Puget Sound. The specified capital of the interurban company is $500,000 and the stockholders named are: A. L. Paine, of Hoquiam, president; E. O. McGlauflin, of Hoquiam; R. F. Lytle, of Hoquiam; W. H. Abel, of Montesano; Eldridge Wheeler, of Montesano; P. S. Locke, of Aberdeen, and A. M. Abel, of Aberdeen.

FOSTORIA, OHIO.—A franchise has been granted to the Fostoria & Fremont Railway Company for the building and operation of a railway from the center of Main Street to the corporate limits of the city. When the franchises are secured through Seneca and Sandusky counties it is proposed to build the best and fastest twenty-one miles of track between Fostoria and Fremont to be found anywhere in northwestern Ohio. This is possible for the reason that it is a straight route between the two cities.

WHEELING, W. VA.—As soon as the weather permits construction work will be pushed on the new street railway from Mannington to Pittsburg via Waynesburg and Carnegie. Already a large portion of this work has been completed and by the first of April cars will be running from Mannington to Morgantown and Blackville. Rights of way have been secured from Blackville to Waynesburg and from there a line has been secured to Carnegie, which will be immediately extended to Pittsburg. The new project is being conducted by West Virginia and Pennsylvania capitalists and the road will be a merger of several lines.

NIAGARA FALLS, ONT.—An unnamed company is seeking power from the Ontario Legislature to build an electric road from this city to Dunnville. Who the promoters behind the proposition are is not known. It is proposed to make this city the frontier terminal of the line and to run the road through the townships of Stamford, Thorold, Crowland, Humberstone, Wainfleet, Moulton, Sherbrooke and Halimand. The line would pass through the center of Welland, the county town, and be the second electric line to enter that city from here, the Niagara, St. Catharines & Toronto Railway now connecting the two places. A branch line would be built to the village of Fenwick.

TOLEDO, OHIO—.The Toledo, Bowling Green & Southern Traction Company has voted to increase its capital stock from $1,500,000 to $2,250,000.

WARSAW, IND.—It is stated that the Winona Interurban Railway Company has been leased to the Winona and Warsaw Traction Company for ninety-nine years.

LOS ANGELES, CAL.—The Pacific Electric Company has planned an electric railway to connect Dolgeville and Alhambra. Engineers have finished the survey. A.

LOS ANGELES, CAL.—The Los Angeles Railway Company has bought a franchise for an electric line on Alpine Street, from Main to Buena Vista, and on Ann Street from Main to San Fernando. A.

ASTORIA, ORE.—An official of the company states that the Lytle railroad, which is now being built from Hillsboro to the ocean at Tillamook Bay, is to be operated by electricity as soon as it is completed. A.

CHIHUAHUA, MEX.—The Chapala Hydroelectric and Irrigation Company has purchased the electric street railways of Aguascalientes and will operate them. The company will transmit hydroelectric power from Chapala to Aguascalientes.

ALBANY, N. Y.—The Public Service Commission has authorized the Hornell-Bath Interurban Railroad Company to issue $250,000 capital stock and $450,000 forty-year five per cent gold bonds for the physical construction of its road.

PERU, IND.—The announcement has been made that work is soon to be started on the work of completing a gap in the Winona interurban railway. As yet the part between Chili and Mentone, a distance of about fifteen miles, is unfinished.

COLORADO SPRINGS, COL.—Work has been begun on the new Kiowa street electric line by the Colorado Springs and Interurban Railway Company. This line will take the place of the old one on Pikes Peak avenue east of the Santa Fe tracks.

PALO ALTO, CAL.—It is stated on reliable authority that the Palo Alto electric line will be extended to the Dumbarton Bridge as soon as the cutoff is completed, which will be some time during next summer. The San Jose line will be in operation about February 1.

BLUFFTON, IND.—The Bluffton, Geneva & Celina Traction Company has completed the line to Geneva, and traction service will be inaugurated as soon as the feed wires are completed. The current for the road will be received from Marion, and portable substations will be used. S.

SANTA CLARA, CAL.—The Commercial League of Santa Clara is working to secure a right of way for the extension of the street car system north to meet the line which is to be run south from Palo Alto, and which is ultimately to form a through electric line from San Francisco to San Jose. A.

VALLEJO, CAL.—The Vallejo and Northern Electric Railway, which has obtained a franchise for the operation of an electric line between Sacramento and Vallejo, has commenced operations and it is expected that a direct line between Sacramento nad Vallejo will be in operation within eighteen months.

GRANTS PASS, ORE.—John B. Allen, who has been seeking franchises for an interurban electric line between Ashland, Medford and Grants Pass, has been granted a franchise by the Grants Pass Council. The franchise runs for fifty years, with proper restrictions as to use and time within which to commence work.

KOKOMO, IND.—The Kokomo & Western and the Kokomo, Frankfort & Terre Haute traction companies are each asking for a subsidy of $35,000 from Center township. The election is called for February 5, and the race between the two companies to build westward is likely to defeat the subsidy asked by each road. S.

SAN JOSE, CAL.—A new corporation has filed articles here under the name of the San Jose Railroads. The company will take over the First Street railroad and will operate it with the Santa Clara lines. It was incorporated with a capital stock of $5,000,000 by L. E. Hanchett, W. R. Lawson, E. M. Rea, F. E. Fitzpatrick and others. A.

LOS ANGELES, CAL.—The city will protest against the application of the Pacific Electric Company to obtain permission to build a bridge over the Los Ceritos slough, a part of the San Pedro Harbor. The bridge is desired as a part of the line to be built by the Pacific Electric from Long Beach to San Diego via Wilmington. A.

LAWRENCE, KAN.—A mortgage was filed recently by the Lawrence Railway and Light Company to the Dayton Savings and Trust Company for $750,000. The electric light plant was purchased and the street railway built on the money of the men back of the concern. The road and equipment cost in the neighborhood of $300,000.

TOLEDO, O.—A new trolley line with a capital stock of $100,000 to be known as the Toledo, Napoleon & Lima Railway Company has been incorporated by M. M. Daily, H. D. Bishoff, M. W. Gillette and M. E. Donaldson. Ten thousand shares of stock will be issued at $10 a share and an electric road constructed between Toledo and Lima. H.

RUTLAND, VT.—The work of surveying the extension of the Rutland Railway, Light and Power Company's line to Poultney is proceeding rapidly. The line starts about four miles from Poultney and will run to a point near Castleton, where it will join the present line to Fair Haven. Work on the power dam at Chittenden is also being pushed.

ROCK ISLAND, ILL.—At a meeting of the Davenport and Manchester Interurban Railway Company an increase of capital stock from $15,000 to $650,000 was voted. The officers of the company are: L. S. Matthews, Monticello, president; J. H. Vorhees, Monticello, vice-president; F. W. Rank, Moline, secretary, and T. F. Halligan, Davenport, treasurer.

STREATOR, ILL.—The first car on the Chicago, Ottawa and Peoria line between this city and Ottawa was run a short time ago. This line is to be a part of the Chicago-St. Louis interurban project of Congressman McKinley, of Champaign. Excepting a few connecting sections the system is now complete. It is owned by the Illinois Light and Traction Company.

INDIANAPOLIS, IND.—The Beech Grove Traction Company has been incorporated, and capitalized at $10,000. The company proposes to build and operate a traction line to connect Indianapolis and Beech Grove, a distance of nine miles. The Big Four shops are located at Beech Grove and there is necessity for the road the company proposes to build. William H. Ogan, Morton S. Hawkins and Samuel E. Hamlin are directors.

CAMDEN, N. J.—Vice-Chancellor Leaming recently appointed James W. Calloway, of Atlantic City, receiver of the Southern Public Service Corporation, incorporated under the laws of New Jersey, to build railroads in South Carolina and Georgia. The company is capitalized at $1,500,000. The receiver was appointed upon application of Ludwig and Company, an engineering concern, which claims the company is insolvent.

MONTREAL, CAN.—The Nipissing electric railway connecting Cobalt with Haileybury and Port Cobalt is now reported as completed, with the exception of the overhead bridge crossing the Temiskaming and North Ontario Railway, which is to be finished very soon. Strong efforts are also being made to extend the Kerr Lake spur of the Government railway through South Lorrain and to Haileybury, a work which will most likely be put through in the near future.

DULUTH, MINN.—The Duluth Street Railway Company has spent close to $350,000 this year for the improvement of its property in Duluth and will probably spend almost as much for the extension of its lines next year. The figures up to the first of October amounted to $251,612. Of this $70,000 was spent for new equipment. The company bought eleven of the largest and most modern type of cars. About fourteen miles of track have either been rebuilt or newly laid in the city.

HIGHLAND MILLS, N. Y.—It is generally believed here that the Erie railway between Jersey City and Highland Mills is soon to be electrified. The plans are also said to include the erection of a big power house in this city. These plans are at present hindered by the indefinite state of the law regarding water rights. Provided these rights were satisfactorily settled, it is thought that the Erie might employ for electric transportation purposes much of the waterpower of the Ramapo Valley.

UVALDE, TEX.—At a recent meeting of the stockholders of the Uvalde & Leona Valley Interurban Railway Company the following officers were elected: Charles Peterson, president; A. M. Avant, first vice-president; M. M. McFarland, second vice-president and general manager; F. J. Rheiner, treasurer, and W. D. Love, general attorney. This company will build an interurban line down the Leona Valley through the irrigated farms, provided the bonus asked is raised. This will make the third railway for Uvalde, two of which will have terminals here.

SAN ANTONIO, TEX.—Plans are being matured for an extensive interurban system covering a large part of Texas, radiating from San Antonio north through Austin to Dallas and Fort Worth. The backers of the project are C. L. Hodges, of Chicago, and L. L. McSweeney, of New York. The line north will run through New Braunfels, San Marcos, Austin, Hillsboro and thence to Dallas and Fort Worth. Power houses will be located every twenty miles along this route. Water power will be used everywhere it is possible. It is expected to incorporate in Austin for $1,500,000 and eventually to build south to Houston and Galveston.

MEMPHIS, TENN.—The Clarksdale, Covington & Interurban Railroad Company, a subsidiary of the Lakeview Traction Company, which proposes to build an electric line from Clarksdale, Miss., via Memphis, to Collierville and Covington, Tenn., has filed an amendment to its charter whereby it seeks to secure the privilege of building four lines in Memphis proper, two running east and west and two north and south. The company has already constructed twelve miles of track between Memphis and Lake View, Miss. During the coming year it proposes to push construction on the remainder of the lines both east and south of this city. The Lakeview Traction Company has a capital stock of $1,500,000 and is chartered under the laws of Maine. Efforts will be made immediately after the first of the year to secure franchises covering the proposed lines in Memphis proper. The company has already secured the necessary terminal facilities, having acquired the old Young Men's Christian Association building and property on Third Street and Monroe Avenue.

MODESTO, CAL.—Work has been begun on the Modesto Interurban Railroad between this city and Empire, on the Santa Fe. A.

STOCKTON, CAL.—The work of building the Stockton Terminal and Eastern Railroad, connecting Stockton with the rock quarries above Jenny Lind, has been begun. A.

RIVERSIDE, CAL.—The announcement has been made that the Crestmore Valley electric line is to be extended to Bloomington and that a franchise will be asked for in Riverside and San Bernardino counties. A.

TITUSVILLE, PA.—A corps of surveyors has begun the work of surveying a route for the proposed new electric railroad from this city to Corry. The work will be pushed as rapidly as the weather will permit.

POMONA, CAL.—The Pacific Electric Company has requested the Board of Trustees to permit it to abandon that part of its franchise which calls for practically all further extension work in Pomona. The request was denied by the Trustees. A.

WILMINGTON, DEL.—Officials of the West Chester and Wilmington Electric Railway Company, which proposes to build a line from this city to West Chester, Pa., state that the road will be started early in the Spring and rushed to completion. Unless work is started in February the company will lose a $5,000 forfeit.

PORTLAND, ORE.—Articles of incorporation for an extensive interurban trolley system have been filed at Olympia, Wash. The company is capitalized with $500,000. The officers are: R. F. Lytle, A. L. Pain and E. O. McGlaufin, of Hoquiam; W. H. Abel and Eldridge Wheeler, of Montesano, and A. M. Abel and Phil S. Locke, of Aberdeen. A.

CHATTANOOGA, TENN.—The Nashville and Adairsville Railway Company, which recently took out a charter to construct an electric railway from Nashville to Adairsville, Ky., will increase its capital to $1,250,000. The proposed route will be practically an air line from Nashville to Adairsville. It is also proposed that a connection be made with the Illinois Central Railroad somewhere in Grayson County. A railroad through this section of country will open territory rich in resources. Both freight and passengers will be handled.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OKARCHE, OKLA.—Wright Bros. will construct a telephone line from this point to Altona. P.

PROCTOR, MINN.—The village council granted a franchise to the Duluth Telephone Company. C.

MARTIN, N. D.—The Sheridan County Telephone Company has been incorporated with a capital of $20,000. P.

SCHAFER, N. D.—J. T. Spence is laying plans for the construction of a telephone line to Dickinson. C.

CHILHOWEE, MO.—The Chilhowee Telephone Company has been incorporated by J. E. Cahill and others. P.

NOONAN, N. D.—The Mutual Telephone Company has been incorporated with a capital stock of $15,000. P.

FOSTER, NEB.—The Farmers Mutual Telephone Company has been incorporated with a capital stock of $10,000. P.

VALLIANT, OKLA.—The Big Ten Telephone Company has been incorporated with a capital stock of $5,000. P.

KOMALTY, OKLA.—The Komalty Telephone Company has been incorporated with a capital stock of $2,500. P.

ORANGE, TEX.—The Orange Home Telephone Company has been incorporated with a capital stock of $40,000. P.

PONCA, OKLA.—The Bois de Arc Valley Telephone Company has been incorporated with a capital stock of $6,000. P.

LINCOLN, NEB.—The Farmers Independent Telephone Company has been incorporated with a capital of $2,000. P.

GRAND FORKS, N. D.—The Grand Forks and Brenna Rural Telephone Company has been organized by Julius Berg and others. P.

GREAT FALLS, MONT.—The Rocky Mountain Telephone Company has applied to the City Council for a twenty-four-year franchise. C.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company has commenced the construction of a telephone line to Somers. C.

ROLETTE, N. D.—The Ox Creek Farmers' Telephone Company, Hans L. Amble, secretary, has been incorporated to construct a telephone line south of here. C.

NEENAH, WIS.—A rural telephone company known as the Clayton Telephone Company has been organized at Clayton to build a line between that place and Neenah. M.

FERGUS FALLS, MINN.—An ordinance has been given its first reading granting a telephone franchise to Joseph Gunn, of Breckenridge; Louis Keane, Gunder Bargelson and others. C.

NASHVILLE, TENN.—The Elbridge Telephone Company has been incorporated with a capital of $10,000 by S. E. Carpenter, W. K. Huey, J. J. Puckett, W. A. Imen and L. R. Simpson.

WOOSTER, O.—The City Council has granted a twenty-five-year franchise to the Wayne County Telephone Company, after an eighteen-months' fight to keep it out of the city in the fear that the Bell company was backing it.

MADISON, WIS.—The Melville Telephone Company, Chippewa Falls, with a capital stock of $5,250, has been organized. The incorporators of the company are George W. White, James W. Melville, James P. Maloney, and James Ryan. M.

CLEVELAND, O.—The Cuyahoga Telephone Company is erecting a new exchange which is to cost in the neighborhood of $250,000. The new building, which is to be called the Princeton Exchange, will enable the company to take care of 10,000 telephones.

GLENS FALLS, N. Y.—The Commercial Union Telephone Company, through its general manager, E. L. Granel, of Troy, and Mayor Charles W. Cool, purchased of James S. Jackson the property at 18 Exchange Street, this city, to be used by the company as a business office and telephone exchange. The company will fit the building with all modern equipment.

FARRAR, IA.—Farmers residing in this city have organized an independent telephone company, the articles of incorporation of which were recently filed. The company is capitalized at $5,000. Its officers and incorporators are: J. T. Dunlap, president; Asa Turner, vice-president; H. E. Fleagle, secretary and treasurer; H. N. Martin, Sanford Goodin, C. Flowerdew and Charles Long, all of Farrar.

ATTICA, IND.—Articles of incorporation have been filed by the West Point Co-operative Telephone Company. The object of the new corporation is to construct and operate a telephone system in Tippecanoe, Fountain and other counties. The directors are as follows: L. J. Clement, J. C. Whitehead, Benjamin Turner, J. E. Martin, D. G. Cheesman, S. R. Stover, G. C. Wolferd, G. R. Tubbs and Charles Turner.

BRISTOL, TENN.—The East Tennessee Telephone Company has leased a building and will at once begin repairing and improving it, preparatory to installing probably $15,000 worth of new equipment. The company will then have one of the finest exchanges any city the size of Bristol affords and will install a new trunk line telephone service into the coal fields and to the east. Work has been begun upon two new copper wire circuits between Bristol and Knoxville, to handle the heavy eastern and northern business that will come over the new lines.

ELECTRICAL SECURITIES.

Never have the prospects been better for a prosperous year than they were at the opening of the present one. The best interests have been uppermost in business, finance and politics. The outcome of the special message sent to Congress by President Taft regarding the regulation of corporations, can only be beneficial to both the corporations and the public. As the cases against the Standard Oil Company and the American Tobacco Company and the question of the Union Pacific Railroad Company to hold the stocks of competing companies, are practically decided now, the decision can not be expected to have much effect on the market.

The securities of the new Chicago City & Connecting Railway Company will be listed in New York.

President Sunny says that the Chicago Telephone Company has 1,413 stockholders, including fifty-two women, thirty-five estates and 102 employes.

A special meeting of the stockholders of the Mexican Light and Power Company has been called for January 20 to vote on increasing the preferred stock by $3,600,000 to $6,000,000 and the common stock by $5,400,000 to $19,000,000.

The Lexington & Boston Street Railway Company has petitioned the Massachusetts Railroad Commission for authority to issue 2,500 shares of stock at $100 a share. Of the stock $225,000 is to pay off the funded debt of the company and $25,000 for working capital.

December traffic on the Metropolitan, Northwestern and Oak Park elevated roads, in Chicago, has broken all records. The South Side Elevated gained 5,000 passengers daily over a year ago, the Oak Park about as much, and the Metropolitan 8,000 over a year ago.

The directors of the Minneapolis General Electric Company have voted to call a meeting of the stockholders January 17, to authorize an increase of $1,000,000 par value in the common stock. If this additional stock is authorized it will be offered at par to stockholders of record January 17. Dividends on the preferred stock have been paid at the rate of six per cent per annum since August 1, 1899, and dividends of four per cent per annum were paid on the common stock from February 1, 1906, to August 1, 1909, inclusive, and November 1, 1909, were increased to six per cent per annum.

The plan of subscription to the 19,452 new shares of Edison Electric Illuminating Company stock will be substantially the same as that of a year ago. Rights accrued to stockholders of record January 5, the date of the special meeting, and will expire January 25, probably. Subscriptions will be called for in two installments, $115 in February and $100 in May, payable at the Old Colony Trust Company, Boston. Interest at the rate of four per cent per annum

will be allowed on the first installment ($115 per share) from February to May, and stockholders may prepay the second installment in February, in which case four per cent interest also will be allowed to May. The shares not subscribed for will be sold by public auction.

American Power and Light Company; regular quarterly dividend of one and one-half per cent on the preferred stock, payable January 3 to stock of record December 28.

Bell Telephone Company of Pennsylvania; quarterly dividend of one and one-half per cent, payable January 15 to stockholders of record January 5.

Boston Suburban Electric Companies; quarterly dividend of $1 a share on the preferred stock, payable January 15 to stockholders of record January 3. This is an increase in the annual rate of from $3 to $4 on the preferred stock.

Manchester Traction, Light and Power Company; quarterly dividend of two per cent, payable January 15 to stockholders of record January 1.

Milwaukee Electric Railway and Light Company; quarterly dividend of one and one-half per cent, payable January 15.

National Carbon Company; quarterly dividend of one and one-half per cent, an increase from a five per cent to a six per cent basis.

National Light, Heat and Power Company; regular quarterly dividend of one and one-fourth per cent on the preferred stock, payable January 1 to stock of record December 24.

Ottawa Light and Power Company; regular quartely dividend of one and one-fourth per cent and an extra dividend of one per cent, payable January 1. The next quarterly dividend will be one and one-half per cent, placing the issue on a six per cent per annum basis.

Pioneer Telephone Company; quarterly dividend of one and three-fourths per cent, and an extra dividend of one per cent, payable December 31.

Porto Rico Railways; quarterly dividend of one and three-fourths per cent, payable January 10.

Public Service Corporation of New Jersey; quarterly dividend of one and one-fourth per cent, payable December 31.

Public Service Investment Company; quarterly dividend of $1.50 per share, on the preferred stock, and a semiannual dividend of $1.25 on the common stock, payable February 1, to stockholders of record January 15.

Southern New England Telephone Company; quarterly dividend of $1.50 per share payable January 15 to stockholders of record December 31.

NEW YORK.

	Jan. 3.	Dec. 27.
Allis-Chalmers common	14¾	14¾
Allis-Chalmers preferred	54⅜	54½
Amalgamated Copper	90⅝	88½
American Tel. & Cable	80	80
American Tel. & Tel. (ex-dividend)	141	142¼
Brooklyn Rapid Transit	79¾	79½
General Electric	159	159½
Interborough-Metropolitan common	24½	24¾
Interborough-Metropolitan preferred	61½	61½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) com.	90½	90¼
Mackay Companies (Postal Telegraph and Cables) pref.	77¼	77
Manhattan Elevated	137¼	137
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90⅞	91
U. S. Steel preerred	125	125¼
Western Union	77	76½
Westinghouse common	82½	81½
Westinghouse preferred	135	135

BOSTON.

	Jan. 3.	Dec. 27.
American Tel. & Tel.	141	142¼
Edison Elec. Illuminating	251	250¼
General Electric	159	159½
Massachusetts Electric common	18	16¼
Massachusetts Electric preferred	78½	78½
New England Telephone	137	138½
Western Tel. & Tel. common	16	16
Western Tel. & Tel. preferred	93½	93

PHILADELPHIA.

	Jan. 3.	Dec. 27.
American Railways	46¾	46¾
Electric Company of America	12¼	12¼
Electric Storage Battery common	59½	61
Electric Storage Battery preferred	59½	61
Philadelphia Electric	14	13⅞
Philadelphia Rapid Transit	27¼	27¼
Philadelphia Traction	89	89
Union Traction	52	52

CHICAGO.

	Jan. 3.	Dec. 27.
Chicago Railways, Series 1	108½	109
Chicago Railways Series 2	39	33½
Chicago Subway	43¼	44¾
Chicago Telephone	134½	137
Commonwealth Edison	119	118½
Metropolitan Elevated common	16½	16½
Metropolitan Elevated preferred	55½	55½
National Carbon common	103	102
National Carbon preferred	130	122½

* Last price quoted.

PERSONAL MENTION.

E. A. BUELE has resigned as manager of the Beaver Dam Fuel and Light Company, of Beaver Dam, Wis.

E. E. DARROW, formerly city electrician of Cincinnati, has been made superintendent of the Merchants Heat, Light and Power Company of Indianapolis, Ind.

G. H. HALL has recently been transferred from the Boston office of the Sprague Electric Company to the motor and generator department in the general offices at New York city.

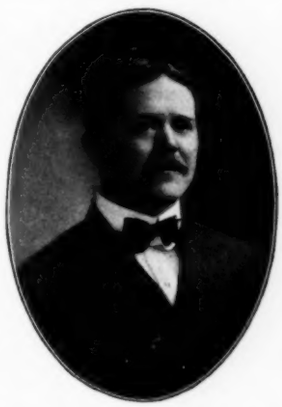
CHARLES A. BOOKWALTER, ex-mayor, Indianapolis, Ind., has been appointed business manager of the Merchants Heat, Light and Power Company, whose new plant is about ready for operation.

W. H. JOHNSON has been appointed superintendent of the municipal light plant at Richmond, Ind. Mr. Johnson is regarded well qualified for the position, having forsaken the law for the electric field.

A. C. COOK of New York has been appointed manager of the Citizens Gas Company at Terre Haute, Ind., by the syndicate which owns the plant and many others in this and adjoining states. Mr. Cook will succeed Mr. E. A. Wakemar, who has been promoted to superintendent of a number of plants.

PROF. H. B. SHAW, dean of the engineering department of the State University of Missouri, has been engaged to make and prepare a report on the electric light and waterworks plant of Columbia City, Mo. H. H. Humphrey, the well-known St. Louis consulting engineer, has been engaged to assist Professor Shaw.

L. H. THULLEN, who is well known in electrical circles as a consulting engineer of New York city, has recently accepted the position of Chief Engineer of the Triumph Electrical Company of Cincinnati, O. Mr. Thullen is the originator of a number of electrical patents and is a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.



P. O. KEILHOLTZ, who has been for over twenty years consulting engineer for the railway and lighting properties of Baltimore, Md., has opened an office as consulting engineer in the Continental Building of that city. Mr. Keilholtz has been closely identified with most of the important electrical work planned and constructed in Baltimore during the last twenty years. He is a graduate of the Engineering Corps of the United States Naval Academy, and after resigning from the naval service he took a post-graduate course at Johns Hopkins University, Baltimore. Besides having an intimate knowledge of the construction of steam and hydraulic apparatus, he is eminently qualified to take the products of different manufacturers and combine them into a complete and efficient operating plant. Mr. Keilholtz has just been commissioned to prepare the plans and supervise the construction of a $100,000 power plant at Millville, Va., for the Winchester & Washington City Railway Company.

EDWARD J. JEEP, who has managed the advertising department of the Wesco Supply Company, of St. Louis, Mo., for the past two and one-half years, has resigned his position and will in the future be connected with the Classified Advertising Company, of St. Louis, in the capacity of business manager. His successor will be R. C. Mellor, who has been connected for some time with the Wesco Company.

J. S. CORBY, one of the best-known incandescent-lamp salesmen in the country, has been appointed sales manager of the Monarch Incandescent Lamp Company, the distributing agent for which will be Fairbanks, Morse & Company. This company has established branch offices in every large city in the country. Mr. Corby will make his headquarters at 481 Wabash Avenue, Chicago. "Sid" is one of the best of good fellows, and his host of friends will join with us in wishing him good luck.

W. J. BEST, for the past three years Chicago sales manager and engineer for the Buckeye Engine Company, has taken a position with the Wheeler Condenser and Engineering Company, Carteret, N. J., with the title of treasurer. Before his connection with the Buckeye Engine Company Mr. Best was for five years sales engineer with the Green Fuel Economizer Company, in their Chicago office, having previously been erecting engineer for E. F. Williams, in which capacity he put in many large steam power stations. For five years previous to this he was eastern engineer, located at New York, for the Buckeye Engine Company. Besides acting as treasurer for the Wheeler Condenser and Engineering Company, Mr. Best will also have charge of part of the sales and engineering work.

OBITUARY.

SPENCER TRASK, who has been for a number of years well known in the financial circles of the country, was suddenly killed on December 30 when a fast freight ran into the train on which he was traveling. At the time of the accident Mr. Trask occupied the drawing room section at the rear of the train, which was standing on the main line when the collision occurred. Aside from being a prominent financier and head of the Trask banking house he has been interested in electrical development from its earliest days. As president for more than twenty years of the New York Edison Company Mr. Trask assisted in establishing the Edison business in New York and Brooklyn. He was also one of the original trustees and for many years one of the executive committee of the General Electric Company.

HENRY L. SHIPPY died Sunday evening, January 2, at his home in New York. Mr. Shippy had been a sufferer for nearly a year past from cancer of the face, and had been gradually growing weaker for the past month, and was unconsious for the last three or four days. The funeral services were held on Wednesday, and the remains taken to Emilie, Pa., for burial, where his father, aged eighty-nine years, still lives. He leaves a widow, one married daughter and one single daughter. Mr. Shippy was born in Emilie, Pa., and was sixty-three years of age. For thirty-four years he was actively and prominently connected with the John A. Roebling's Sons Company, of Trenton, N. J., and for the greater portion of this period was treasurer of the John A. Roebling's Sons Company, of New York. He possessed a very wide acquaintance in this country and abroad and had an extremely large number of friends. He had been an extensive traveler, visiting South Africa and other distant points in the interest of the great company he represented. A few years ago he was given a silver loving cup on the occasion of a dinner extended to him by his associates in celebration of the twenty-fifth anniversary of his connection with the Roebling company. F. W. Roebling presided, and paid a high tribute to Mr. Shippy as a man and as an able member of the Roebling staff.

NEW INCORPORATIONS.

CAMDEN, PA.—The Power Equipment Company has been incorporated to engage in the business of mechanical and electrical engineers; capital, $125,000; incorporators, Oliver M. Scifle, Cyrus S. Eoes, Frank Ferguson.

CHICAGO, ILL.—The Electrical Engineers Equipment Company, of Chicago, has been incorporated with a capital of $10,000, by J. T. Tyrrell, J. U. Dunn and Percival Steele. The company will manufacture electrical appliances.

TRENTON, N. J.—Sauer Power Generating Company, Camden; has been incorporated with a capital of $100,000; incorporators, Adelbert Sauer, Herman J Voegtle and V. A. Murray. The company is to manufacture motors, engines, etc.

NEW HAVEN, CONN.—The New Haven Electric Manufacturing Company has been granted a certificate of organization. The officers are: President, John H. Fruin; vice-president, William R. Hoyt, both of Cheshire; treasurer and secretary, Harry C. Barber, of North Haven.

NEW PUBLICATIONS.

FUEL TESTS WITH HOUSE-HEATING BOILERS, by J. M. Snodgrass, has been issued by the Engineering Experiment Station of the University of Illinois as Bulletin No. 31. It reports 130 tests of anthracite, Pocahontas coal, coke and Illinois coal made in connection with two types of house-heating boilers. Copies may be obtained gratis upon application to Prof. W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

WESTERN ELECTRICAL AND GAS DIRECTORY.—The Blanchfield Publishing Company, Monadnock Building, San Francisco, Cal., has published the 1910 edition of Blanchfield's Western Electrical and Gas Directory. This annual publication is a comprehensive compilation of electric light and power plants, electric railways and gas plants in the Pacific Coast States. A total of 1,345 public utility companies and individuals in this industry doing business in Arizona, California, Idaho, Nevada, Oregon, Washington, British Columbia and the Hawaiian Islands is listed.

FORESTS OF THE UNITED STATES.—The United States Forest Service has issued Circular 171 entitled "The Forests of the United States; Their Use." This publication was prepared by O. W. Price, R. S. Kellogg and W. T. Cox of the Forest Service, and gives a good idea of the extent of the American forests, what is produced by them, what is wasted therein, and what should be done in the way of stopping forest fires, recognizing the value of timber, conservative turpentining and intelligent logging. The bulletin also treats of economy in lumber and mill methods, the advantageous utilization of by-products, preservative treatment of timber, the use of substitutes for wood, better tax and fire laws, and desirable education to give a proper insight into the value and importance of the conservation of the forest resources of the country.

REPORT OF THE COMMISSIONER OF EDUCATION.—The first volume of the annual report for the fiscal year ended June 30, 1909, of the United States Commissioner of Education has been printed in book form, comprising some 610 pages. It is a comprehensive survey of the progress attained in nearly all educational fields, both in this country and abroad. Among the great mass of educational topics discussed are the establishment of an engineering department at Northwestern University, Evanston, Ill.; a new course in mining engineering at the University of Wisconsin, Madison, Wis.; and an engineering experiment station at the University of Utah. Considerable space is devoted to industrial education and in this connection an outline is given of the Metropolitan Street Railway Company's Training School in New York city.

HANDBOOK FOR WIRELESS TELEGRAPH OPERATORS.—The revised edition of this little manual, under date of October, 1909, has been issued by the British Post-Office authorities at the nominal price of six cents. The first paragraph of the book, explaining fully the purpose of this publication, is as follows: "This book is intended as a manual for the guidance of wireles stelegraph operators on board ship and at coast stations with regard to the acceptance and treatment of radiotelegrams, the transmission and receipt of signals, and other details of actual working. It does not in any way deal with the scientific principles of wireless telegraphy, the details of apparatus, or the differences of the various systems. For the most part the instructions apply primarity to operators on board ship but for the sake of completeness certain instructions have been added which apply only to operators at coast stations."

THE TUNGSTEN 250-WATT 110-VOLT LAMP.—The Engineering Department of the National Electric Lamp Association has just issued Bulletin 6 F relating to the new 250-watt, 110-125-volt, multiple tungsten lamp. This bulletin describes the new system of rating tungsten multiple lamps on the three-voltage, three-efficiency basis. Each lamp bears a label giving its designation in total watts and giving also three voltages, the uppermost of which is the voltage which causes the filament to operate at its highest rate efficiency. The two lower voltages are those at which the lamp may be burned with decreased efficiency but increased life. A large number of tables are given showing the characteristic data for this new size, as well as for the other standard tungsten lamps now on the market; variation of candlepower with voltage for the 250-watt tungsten lamp; the operating cost of this unit in comparison with other types of incandescent lamps, as well as with enclosed arc lamps, and three-glower Nernst lamps. Other tables give the types of Holophane reflectors best adapted for the various sizes of tungsten lamps and illumination data for the 250-watt lamp.

INDUSTRIAL ITEMS.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., and Chicago, Ill., is distributing a very handsome calendar for the year 1910.

THE McROY CLAY WORKS, the Rookery, Chicago, Ill. manufacturers of clay conduits for telephone, telegraph, electric light and power cables, is distributing its January calendar-blotter.

THE COLUMBIA METER COMPANY, Indianapolis, Ind., manufacturers of electric integrating, kilowatt-hour meters, is distributing an attractive calendar for the year 1910.

THE ASBESTO-GLEAM MANUFACTURING COMPANY, New York, N. Y., manufacturers of asbestos shades and reflectors, is distributing a circular devoted to its products. The Asbesto-Gleam shades resemble the ordinary shade in form and shape. They are light, being made of asbestos fibre. They combine the qualities of cheapness, durability and effectiveness and are made in all standard sizes and shapes.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has ready for distribution its very convenient diary for 1910. It has more information of value in compact form than the previous issues. Among the mass of valuable data are interesting facts connected with single-phase and direct-current railway systems; transformers; copper wire tables; convenient formulas and equivalents of units; applications of motors to machine tools; storage battery and steam turbine data; a large number of maps of this and foreign countries; data on gas engines; incandescent lamps; Cooper-Hewitt lamps; Westinghouse-Nernst lamps; railway signaling, etc.

THE CENTRAL STATION DEVELOPMENT COMPANY, of Cleveland, Ohio, has been organized with the object of working in harmony with various central stations in order to develop their commercial departments. The vice-president and general manager of the new company, W. H. Wissing, gained an enviable reputation for himself by the aggressive and successful methods used in the development of the new business department of the Union Electric Light and Power Company, of St. Louis, Mo. These methods will be the basis for the work of the new company. Particular attention will be given to co-operating with central stations in various ways for interesting dealers and contractors. The president of the company is E. J. Kulas, who is also president of the Tungstolier Company. The secretary and field manager is T. M. Roche, who is also well known in connection with the Tungstolier business. These gentlemen, with Mr. Wissing, will direct the affairs of a staff of ten practical men who have had extended experience in central-station commercial work.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., manufacturers of electric vehicles, is distributing a circular containing a partial list of users of its vehicles. This list is of significant value, as it contains many names of national reputation.

THE DETROIT COPPER AND BRASS ROLLING MILLS COMPANY, Detroit, Mich., has recently placed an order with Allis-Chalmers Company for additional machinery for its power plant including one 750-kilowatt, three-phase alternator direct-connected to a low-pressure turbine.

THE NATIONAL CONDUIT AND CABLE COMPANY, Hastings on Hudson, N. Y., recently placed an order with the Allis-Chalmers Company for thirteen induction motors varying in size from fifteen to seventy-five horsepower. A steam turbine unit of the same company's build is now being installed.

THE BRUCE-MACBETH COMPANY, of Cleveland, Ohio, manufacturers of vertical multicylinder gas engines, has opened a branch office in the Drexel Building, Philadelphia, Pa. This branch will be in charge of M. E. Jackson, who will be prepared to furnish complete information relative to gas engines, producers and complete gas-power plants.

M. KLEIN & SONS, Chicago, Ill., makers of linemen's and construction tools, report a greatly increased business during the past few months. The company is filling more orders than ever from American users and lately has received quite a number of export orders. Shipments have just ben made to South Australia, India, Central America and other foreign countries.

THE AMERICAN STEEL FOUNDRIES COMPANY has just placed an order with the Allis-Chalmers Company for an additional generating unit for its plant at East St. Louis, Ill. This will consist of a 16 and 26 by 36 tandem compound non-condensing engine directly connected to a 300-kilowatt, 250-volt, direct-current generator. The company has also ordered for its plant at Indiana Harbor, Ind., a duplicate of the above-described generating unit.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn., has recently issued a catalog listing the complete line of Billings drop forged pure lake copper commutator segments, for all standard street railway motors and generators. They are drop forged of one single piece and are of a perfectly homogeneous molecular structure throughout; the fibre or grain of the copper being so arranged as to be everywhere parallel with the axis of the arm, and of the greatest possible density.

THE NORTHERN EQUIPMENT COMPANY, of Chicago, which recently absorbed the American Boiler Economy Company, reports that on account of the rapid increase in the sales of the Copes boiler-feed regulator and the Copes pump governor, it has been compelled to move to a larger factory building. The factory and main offices are now located at 408-418 West Indiana Street, Chicago, to which address any requests for catalogues, etc., should be sent, where they will receive prompt attention.

THE W. H. ZIMMERMAN COMPANY, of Chicago has been incorporated to do a general engineering business with main offices in the First National Bank Building, Chicago, and a branch in Lansing, Mich., where Mr. Zimmerman has been general manager of the Michigan Power Company during the construction of its plants in accordance with plans and specifications prepared by him. The W. H. Zimmerman Company is doing designing, supervising and general consulting engineering work, along electrical, civil and mechanical lines.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., the well-known dealer in second-hand electrical machinery, announces that it has bought the three-phase induction motors formerly in the plant of the Corn Products Manufacturing Company, Chicago. This purchase amounts to 3,000 horsepower in motors, ranging from ten horsepower to 150 horsepower. The machines are in perfect order, the sale being due to the removal of the Corn Products Company's factory to Argo, Ill. The Gregory company will be pleased to give further information concerning this sale to interested parties.

THE BRISTOL COMPANY, Waterbury, Conn., has recently distributed Bulletin No. 114, devoted to Bristol's recording gauges for pressure and vacuum. This bulletin covers a complete line of recording pressure, vacuum and water level gauges which include several different models, with six, eight and twelve-inch dials, for switchboard, stationary and portable service, covering all commercial ranges of pressure and vacuum. Each type of instrument is illustrated and described and in addition to the other data contained therein makes this publication particularly valuable.

THE WESTERN ELECTRIC COMPANY, of Chicago and New York is distributing bulletins 1001 and 1002. These bulletins take up in detail the construction and operating features of magneto non-multiple switchboards with self-restored and manually restored line signals. They contain illustrations of the different essential parts of line circuit apparatus, cord circuit apparatus, as well as different styles of switchboards. Numerous diagrams are also shown illustrating the wiring connections for the various parts. The same company has also published a new issue of their bulletin 5131, which shows in detail their type IL of motors and generators, and a new issue of bulletin 5132, taking up the type ELC motors of interpole design. These bulletins are ready for distribution.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., will furnish considerable new equipment for the Panhandle Lumber Company, of Spirit Lake, Idaho, which company is going to make extensive additions and improvements to its property at Ione, Washington. This order includes a turbo-generator set which will furnish 600 kilowatts at eighty per cent power-factor, 480 volts, sixty cycles, three-phase current, when running at 3,600 revolutions per minute on 120 pounds steam pressure and twenty-eight inches vacuum. The condensers will be Allis-Chalmers Type C with motor-operated centrifugal pumps for cooling water and ejection. Excitation current for starting and reserve will be furnished by a twenty-five-kilowatt, non-condensing, turbo-generator set; and for operating, a twenty-two and one-half-kilowatt motor-generator set will be supplied.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., announces that on November 12, an important decision was rendered by the United States Court of Appeals for the First Circuit, sustaining the Thalacker patent, 502,541, which covers substantially all forms of indicating enclosed fuses. In the opinion of the Court, as stated by Judge Lowell, "the gist of the Thalacker patent consists in the combination with these old elements (the main fuse and its casing) of an auxiliary fuse whose condition is at all times conveniently observed, so that by reasonable inference the condition of the main fuse may be known." The Court held "the invention goes beyond the mere details shown and the patent should receive a construction correspondingly broad." This decision was rendered in the suit brought by the General Electric Company against F. B. Smith, sales agent for the Sachs fuses.

DATES AHEAD.

South Dakota State Independent Telephone Association, Hudson, S. D., January 11-13, 1910.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Wachtung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting, Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frasse, Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Perry-Payne Building, Cleveland, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick Streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 627 Jackson Boulevard, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 25 West Forty-second Street, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK. (Member National Electrical Trades Association.) Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allan J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, F. M. Tait, 124 East Fourth Street, Dayton, Ohio. Executive secretary, T. C. Martin, 33 West Thirty-ninth Street, New York city.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Chicago, Ill.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State Street, Boston, Mass.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 28, 1909.

944,258. INDIVIDUAL PROTECTOR. Frank B. Cook, Chicago, Ill. Original application filed June 10, 1908. Divided and this application filed February 18, 1909. Fusible wires passing through holes in an insulating block are connected at one end to lightning arresters.

944,259. INSULATOR. August G. Dennler, East Hampton, Conn., assignor of one-third to William F. Quigg, East Hampton, Conn. Filed February 23, 1909. A groove in the insulator for a main-line wire is intersected by converging slots.

944,271. CURRENT-TESTING DEVICE. Harry H. Morrell, New York, N. Y. Filed September 22, 1908. A taper stem has fitted to it a handle and may be clamped to an electric wire.

944,305. FIRE-ALARM. Bolivor C. Andrews, Mabank, Tex. Filed April 10, 1909. A cord is disposed so as to be burnt and broken by a possible fire and thus release a spring, thereby operating the push button of an electric alarm.

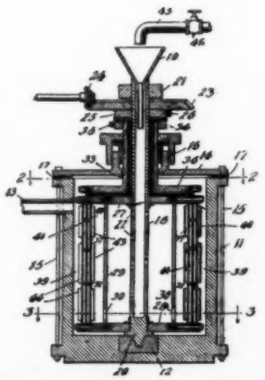
944,319. ELECTRIC TIME-SWITCH. George R. Clark, Dayton, O., assignor to Clark & Harvey, Dayton, O. Filed July 3, 1907. Means controlled by the timing mechanism cause an electrically actuated operating mechanism (for periodically winding up the timing mechanism) to actuate the switch during one of the periods of winding.

944,459. INSTRUMENT FOR LOCATING GROUNDS AND BREAKS IN ELECTRIC-CIRCUITS. Matthew J. Myers, Syracuse, N. Y. Filed October 13, 1902. Renewed May 19, 1909. A magnetizable member carried by a support is subjected to the differential influence of other magnetizable members.

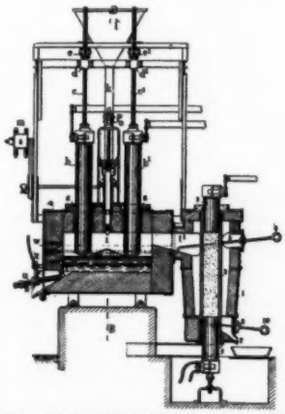
944,460. SELECTING APPARATUS FOR TELEPHONE SYSTEMS. Charles E. Nicholas, Columbus, O., assignor to Nicholas Telephone Selector Company, Rochester, N. Y. Filed December 18, 1901. A switch is moved one way or the other, according to the polarity of the currents, through a polarized electromagnetic operating device.

944,494. DOOR-CONTROLLING DEVICE. Adolphus L. Noel, Mason City, Ia. Filed December 15, 1902. A motor device is associated with a movable part, which is automatically and electrically released.

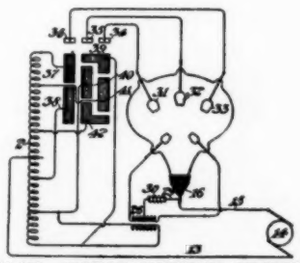
944,497. ELECTROMAGNETIC ACCELERATOR. Charles O. Pearson, New York, N. Y., and August Sundh, Yonkers, N. Y. Filed August 17, 1908. The driving and driven shafts are connected by electromagnetic clutches successively and gradually energized or de-energized.



944,650.—ELECTROLYTIC APPARATUS.



944,774.—ELECTRIC FURNACE FOR ZINC.



945,006.—MOTOR CONTROL SYSTEM.

944,347. DOUBLE-ENDED RECEPTACLE. Howard R. Sargent and Frank C. De Reamer, Schenectady, N. Y., assignors to General Electric Company. Filed July 9, 1907. A double-ended receptacle for electric lamps comprises a body and cover having semitubular projections on opposite sides forming sockets.

944,412. TELEPHONE-BOX. William M. Bruce, Jr., Springfield, O., assignor to The American Automatic Telephone Company, Rochester, N. Y. Filed April 4, 1907. Renewed May 26, 1909. The telephone-box (with its hinged cover) is fastened to a hinged lid which has openings registering with the openings for the fastening device for the base, so that the base may be removed or secured without removing the lid.

944,453. CONTROL OF ELECTRIC MOTORS. Henry A. Mavor, Mile End, Glasgow, Scotland. Filed September 4, 1909. Auxiliary motors are provided for driving the controllers for the exciter and motor of a combination of motor and generator, and interlocking means insure that one such auxiliary motor can alone be in operation at a time.

944,525. ELECTRIC CONTROLLER. William Walz, Toronto, Ontario, Canada. Filed February 10, 1909. Each of a number of circuit breakers is electrically connected individually with one of a number of motors, and all the breakers are connected together in series parallel and to an electric-current supply. Means are provided for connecting all of the circuit breakers and their corresponding motors in parallel.

944,537. SEMI-MECHANICAL TELEPHONE SYSTEM. Albert M. Bullard, New York, N. Y., assignor to Westinghouse Electric Company, Chicago, Ill. Filed February 19, 1908. Describes a form of key-actuated controller.

944,545. ELECTRIC SIGNAL. Amos F. Dixon, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed March 6, 1907. The signal target is composed of two normally superposed iron parts which may be electromagnetically caused to repel each other so that the movable part may swing open on its hinge.

944,563. SIGNALING SYSTEM. Otto T. Lademan, Milwaukee, Wis. Filed February 15, 1909. A step-by-step device at the central station is associated with switching devices for causing a selective operation of the substation signal-controlling devices.

944,575. COMBINED TELEPHONE AND PROTECTIVE ALARM SYSTEM. James G. Nolen, Chicago, Ill., assignor to John E. Shepard, Chicago, Ill. Filed February 26, 1906. An electrically initiated aural alarm device is provided, having its electro-responsive part operatively associated with the circuit closable by the protective circuit closer and energized by a central source of supply.

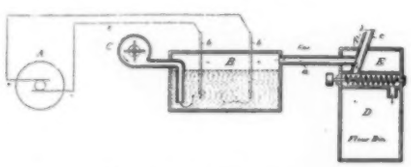
944,605. ELECTRIC SAFETY-BOX. Harry A. Fisher, Plainville, Conn., assignor to Trumbull Electric Manufacturing Company, Plainville, Conn. Filed September 30, 1908. Two shutters are pivotally secured to the side of the box on opposite sides of a circular opening of greater diameter than the opening in the shutters provided by adjusting corresponding ones of a number of variously sized semicircular cuts in the shutters.

944,612. PERFORATING APPARATUS. Fernand E. d'Humy, Englewood, N. J. Filed June 25, 1909. The punches are electromagnetically actuated.

944,650. ELECTROLYTIC APPARATUS. Harry H. Bates and Folger Adam, Joliet, Ill. Filed June 7, 1909. An electrolytic cell for producing chlorates from chlorides has moving anodes and cathodes mounted so as to move in the same direction on a common axis.

944,665. SELECTIVE ELECTRIC SIGNALING APPARATUS. John B. Coe, Boston, Mass., assignor of one-fourth to Frank B. Lenzi, Boston, Mass. Filed September 25, 1908. A movable terminal is common to all of a number of open circuits at one end and may be connected at will to any one of them at the other.

944,667. INCANDESCENT LAMP. Charles H. Crutchfield, New Boston, Tex., assignor of one-half to Andrew W. Deshong, New Boston, Tex. Filed September 9, 1908. The filament is disposed about a hollow body which comprises a series of transparent concaved sides and a concaved end.



13,064.—PROCESS OF TREATING FLOUR.

944,686. AUTOMATIC GAS-REGULATOR. George H. Murray, Bristol, Vt. Filed August 10, 1909. A detent, which engages a weighted stem forming a gravity-actuated valve, is electromagnetically actuated by means of a thermostat.

944,733. TIME-CONTROLLER FOR BURGLAR-ALARM SYSTEMS. Maximilian F. Juruick, New York, N. Y., assignor to Electric Bank Protection Company. Filed August 16, 1907. A clock hand normally contacts with the (insulated) clock face.

944,774. ELECTRIC FURNACE FOR THE CONTINUOUS EXTRACTION OF ZINC FROM ITS ORES. Eugene F. Cote and Paul R. Pierron, Lyon, France. Filed May 14, 1907. An outer casing communicating with the furnace forms a condenser, and within this is an inner casing having at each end an electrode. The electrodes are movable toward and from each other, and non-fusible material is arranged between them.

944,785. RHEOSTAT. Robert Head, New York, N. Y., assignor to Robert L. Watkins, New York, N. Y. Filed October 27, 1908. Resistance coils are mounted on suitable supporting strips carried within a series of yieldably connected frames.

944,822. PROCESS OF TREATING OR IMPREGNATING PLANTE NEGATIVE PLATES. Hugh Rodman, Pittsburg, Pa., assignor to Westinghouse Storage Battery Company. Filed March 24, 1906. The active mass, or mass to become active, is impregnated with a compound of the barium group.

944,826. PRODUCTION OF ALLOYS OF ALKALI-EARTH METALS, ETC. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Company, New York, N. Y. Filed March 28, 1906. A mixture of fused compounds is electrolyzed so that the concentration of the less electro-positive metal is maintained so low that the alkali-earth metal is separated jointly with the less electro-positive metal.

944,869. TROLLEY APPARATUS. Charles O. Jackson, Fairmont, W. Va. Filed April 3, 1909. Independent spring-pressed members are pivotally mounted on the trolley head, one on each side of the wheel.

945,008. MOTOR-CONTROL SYSTEM. Percy H. Thomas, Pittsburg, Pa., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed September 4, 1903. Divided and this application filed December 4, 1903. Renewed May 17, 1906. A variable-potential direct-current work circuit is fed by an alternating-current supply circuit, through a vapor converter having one or more supplementary positive electrodes. The non-operating positive electrodes can be connected successively to points of higher and higher potential in the supply circuit.

945,008. MOTOR-CONTROL SYSTEM. Percy H. Thomas, Pittsburg, Pa., assignor to Cooper Hewitt Electric Company. Filed September 4, 1903. Similar to the preceding.

REISSUES.

13,060. ELECTRIC TOASTER. William S. Andrews. Schenectady, N. Y., assignor to General Electric Company. Filed November 27, 1909. Original No. 936,597, dated October 12, 1909. The bread is received in basket-like arrangements on opposite sides of the heating devices.

13,064. PROCESS OF TREATING FLOUR. John M. Williams, Guthrie, Okla., assignor to Electric Catalytic Air Company. Filed September 4, 1906. Original No. 769,522, dated September 6, 1904. The flur is whitened and purified by electrolyzing an oxygen-yielding liquid and forcing the gaseous product through the flour.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 3, 1910:

488,978. BRUSH HOLDER FOR DYNAMOS AND ELECTRIC MOTORS. Ralph Ashley, Philadelphia, Pa.

488,993. TELEPHONE SWITCH. John C. Francis, New York, N. Y.

489,000. COMMUTATOR FOR DYNAMOS AND ELECTRIC MOTORS. Henry Groswith and Ralph Ashley, Philadelphia, Pa.

489,026. TRANSMITTING MECHANISM FOR MOTORS AND DYNAMOS. Henry W. Norton, Boston, Mass.

489,046. ELECTRIC ARC LAMP. Elihu Thomson, Swampscott, Mass.

489,065. ALTERNATING-CURRENT DYNAMO. James J. Wood, Fort Wayne, Ind.

489,070. ARMATURE FOR ELECTRIC MOTORS OR DYNAMOS. Cornelius F. Daniels, Macon, Ga.

489,071. FIELD MAGNET FOR ELECTRIC MOTORS OR DYNAMOS. Cornelius F. Daniels, Macon, Ga.

489,098. TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS. Chas. E. Scribner, Chicago, Ill.

489,100. TEST CIRCUIT FOR MULTIPLE SWITCHBOARDS. Chas. E. Scribner, Chicago, Ill.

489,113. OPERATING DEVICE FOR BRIDGE GATES. Edward Zaremba, Chicago, Ill.

489,114. ELECTRIC METAL WORKING. Craig R. Arnold, Sharon Hill, Pa.

489,115. SECONDARY BATTERY. Craig R. Arnold, Sharon Hill, Pa.

489,150. ELECTRIC LANTERN. Adam Keil, McKeesport, Pa.

489,161. ELECTRIC METER. Heinrich Illig, Bockenheim, Ga.

489,174. SHEAVE STAND FOR SWITCH-OPERATING MECHANISMS. Samuel R. Wilmot and Frank A. Wilmot, Bridgeport, Conn.

489,186. STORAGE BATTERY ELECTRODE. George W. Harris, New York, N. Y.

489,234. ELECTRIC RAILWAY TROLLEY. Jean Reutlinger, St. Louis, Mo.

489,237. FIRE ALARM. Wm. J. Schweiger, New York, N. Y.

489,249. ELECTRICAL MEASURING INSTRUMENT. Johannes H. F. Gorges, Berlin, Germany.

489,266. TELEPHONE SWITCH APPLIANCE. Parnell Babridge, Sydney, New South Wales.

489,277. ELECTROMAGNET. Richard Varley, Jr., Englewood, N. J.

489,302. DYNAMO-ELECTRIC MACHINE AND MOTOR. Walter T. Goolden and Llewelyn B. Atkinson, London, England.

489,312. FIRE OR BURGLAR ALARM. Elzear La France, Worcester, Mass.

489,318. ELECTROMAGNETICALLY HEATED RECEPTACLE. Willis Mitchell, Malden, Mass.

489,330. ELECTRIC ELEVATED RAILWAY. Andrew L. Rutter, Washington, D. C.

489,423. ELECTRIC TIME ALARM. Jacob P. Tirrell, Boston, Mass.

489,424. VALVE CONTROLLING CLUTCH. Jacob P. Tirrell, Boston, Mass.

489,435. TELEGRAPHY. Leroy P. Hotchkiss, Oak Park, Ill.